COAL AGE

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THE eyes of the world have been watching the various phases of state activity in New Zealand, hoping to learn something that might be used in the social reform of other nations. Having become the sociological experiment station of the universe, she is rather expected to try out all radical ideas for the benefit of humanity. The country is remote, has a homogeneous population of intelligent, well educated people who have a high standard of public virtue; the climate is healthful and the soil fertile, so that important conditions are favorable to the work in hand.

If in any country, therefore, the ideals of Utopia could be realized, surely New Zealand affords the chance. But has the aim been accomplished? Let us briefly analyze the results the government has secured from having established Old Age Pensions, Parcels Post, Savings Bank, Fire Insurance, Life Insurance, a system of Telegraphs, Telephone Exchanges, and from operating Coal Mines.

To receive a state pension the citizen must be 65 years old, sober and reputable and 25 years a resident. His income must not exceed $300 annually, and his accumulated property must not amount to $1300 or over. The full pension of $130 a year is reducible by $5 for every $5 of income over $170. Thus when the applicant's yearly income reaches $300, the right to any pension is lost. Likewise, a reduction of $5 is made for every $50 of accumulated property.

As to state insurance, state ownership of mines, and government management of railways and other public enterprises, the plan of conducting all such activities on sound business principles has lately been adopted. This policy prevails not only where the state is competing with private effort, but in government monopolies, where lack of competition tends to cause expensive management, obsolete methods and unreasonable concessions to public clamor. The present aim is to make each business pay at least interest on the capital invested.

The most recent reports at hand show that the annual profits of the Post and Postal Telegraph Departments are approximately $500,000. The State Coal Mines netted the government another $100,000. The railways showed a deficit of $1,030,000, while the net profits to the state from 5 per cent. loans made to settlers was $325,000.

Telegrams and telephone service are cheaper than in the United States. Railway fares are practically the same (2c. per mile). The price of coal is higher than when the government first went into the business. Wages, as compared with the cost of living, are slightly lower than in this country, and the net public debt of New Zealand ($329,000,000) amounts to $340 per head, which forms a striking comparison with our net debt of $10 per head. The enormous net debt of New Zealand, however, does not seem so great when compared with the total private wealth of the country, which is $1628 per head, a greater per-capita wealth than that of any other nation.

It would be unfair to say that the mild form of socialism prevailing in New Zealand is a failure. But has it improved conditions? Of 1,000,000 inhabitants, 130,000 are directly dependent on the state. Poverty has not been abolished, for there are just as many paupers in the towns of New Zealand as in American cities. Also the distribution of wealth is not much more equal, since statistics show that 1 per cent. of the families in that country own 35 per cent. of the wealth, a condition but little better than that which exists in the United States.

Strange to say, socialistic legislation has had an effect that certainly was not socialistic. Discontented and land-hungry laborers, through state aid, have been converted into prosperous citizens, strong supporters of the freehold and ardent advocates of the sanctity of private property.

There is still a discontented class, who, having little to tax and nothing to lose, desire to exploit the rich, regarding the capitalist as a goose to be kept for the sake of its golden eggs. We should study New Zealand's scheme of compulsory arbitration and her system of old-age pensions. Also, if it will make our coal industry more stable, we would like to see Uncle Sam operating a few mines of his own, but to believe that results so far attained in this far-off country point a way out of the tangled woods of social unrest is hardly justified by the facts that exist.

The Acme Co.'s Plant in Wyoming

By Jesse Simmons*

A detailed description of one of the largest and best equipped plants in the Sheridan, Wyo., field, a general description of which was recently published in COAL AGE. An unusual refinement in sizing the coal is attained by the use of a shaking screen with both a lateral and longitudinal motion; this is one of only four or five such screens in use in this country.

*Deadwood, S. D.

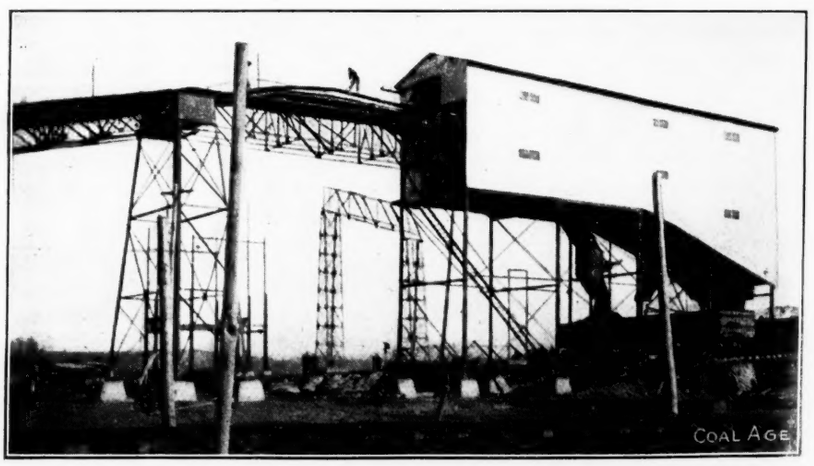
The mines of the Sheridan, Wyo. coal field are operating on seams that have been designated by the Geological Survey as sub-bituminous, but are more commonly known locally as lignite. Whether this coal is a true lignite, in the common acceptance of the term, is a question the Survey men evaded by giving the new name. The coal differs from the ordinary lignite in that it contains less moisture and far less ash. In color it is black instead of brown, and it has a high gloss, almost as bright as the best grades of anthracite. It burns freely to a clean, light ash, having a resemblance to wood ash.

Because of the fact that it is mined from large clean seams and nearly all of the mines leave a coal roof, the resulting product is exceptionally clean. It contains barely more than traces of sulphur. For steam purposes it is a good fuel, and is used in large quantities by the C. B. & Q. R.R. As a coal for domestic use it is in some ways superior to the ordinary bituminous, as in burning it leaves almost no soot, and for this reason, as well as its freedom from clinkers and sulphurous gas, it derives merited popularity.

Of the several mines in the Sheridan district the newest and one of the best equipped, as well as one of the largest, is the Acme Coal Co.'s property. This company is but two years old, and owns three mines. Mine No. 3 is operating in the top seam of the district, which is known locally as the Monarch. Mines 1 and 2 are working in the Carney, or second seam, the Monarch being eroded at this point. Mines 1 and 2 are on a property comprising about 300 acres, 3 miles west of the 1100-acre tract on which Mine No. 3 is located. The former property is operated under a short term lease, and the latter under a ninety-nine-year contract. All three openings are made in the bluffs of the Tongue River, by drifts having a slight inward dip.

The Acme No. 3 Mine

The main entry of the Acme No. 3 mine is in the bluffs of the Tongue River, on the northerly side of the stream. From the pit mouth the track, which has a 42-in. gage, and is laid with 45-lb. rails, both on the surface and in the main haulageway, follows the bluffs westerly, and crossing a steel bridge, enters the yards. At a point 250 ft. from the foot of the inclined approach to the tipple, the electric locomotives are uncoupled and the cars picked up, one at a time by a cable haul. The essential features of this haul are a 1¼-in. steel cable to which are attached 4-wheel trolleys, equipped with dogs which engage lugs on the car axles, the trolleys running on 16-lb. rails. The haulage is controlled by a friction clutch, making it possible to give the proper feed to the cars going up the incline.



Acme Co.'s Steel Tipple, Showing Re-screening Plant and Chutes

At the foot of the incline the cars are picked up by a cable haul similar in detail to the one described, which takes them to the top of the tipple. The top of the incline is 49 ft. above the yard tracks, and has a grade of 15 deg. The cars are dumped over a crossover dump, and automatically transferred by means of a double track system, down the approach, and made up into trains for return to the mine.

When the coal is dumped from the mine cars it enters a large bin provided with a movable bottom, or feeder plate, arranged to be operated at varying rates of speed. This delivers the coal to a shaker-screen of special design having a capacity of 3000 tons per day and openings 6 in. in diameter. Having both longitudinal and lateral motion, the makers of this screen claim it has an important advantage over other types. It is one of four or five in this country, but it has been extensively and successfully used in Germany.

From this screen coal may be diverted into either open or box-cars, a standard Ottumwa box-car loader being used to load the latter. By cutting out the screen, which is done by covering it with movable steel plates, mine-run may be loaded direct into the cars. As a further precaution in the preparation of lump, the coal before entering the railway cars passes over grizzlies, thus removing the last vestige of slack and dust which might have been carried to this point.

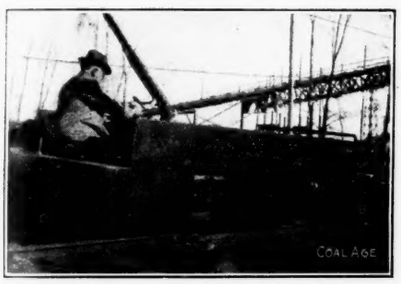
Re-Screening Plant

The coal passing through the shaker-screen may be either diverted to open cars on the slack track, or to an elevator boot from whence it is conveyed by a 30-in. rubber-belt conveyor, 265 ft. long, to a revolving screen 65 ft. above the ground, at the top of what is known as the re-screening plant. This screen is 24 ft. in length, and for one-half of the length an outer screen 7 ft. in diameter surrounds the main screen, which is 6 ft. in diameter. Beginning at the upper end, the openings in the main, or 6-ft. screen, are as follows: 1-in., for the first 12 ft.; next a 6-ft. section with 2-in. openings, while the remaining 6 ft. has 3½-in. openings. The outer screen has ½-in. openings, and surrounds that portion of the inner screen having 1-in. openings.

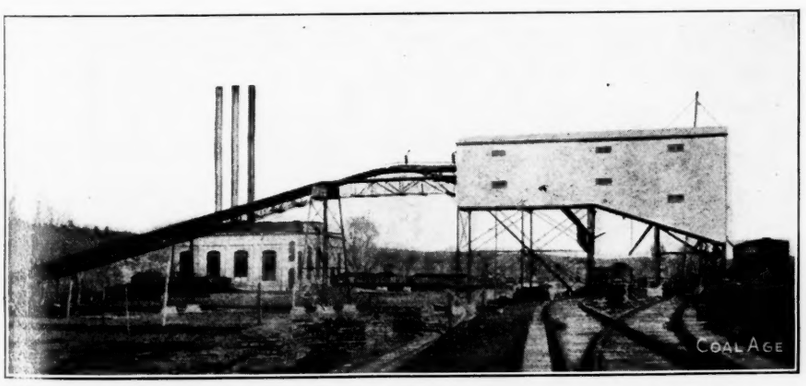
The following grades of coal can be made at this plant: At the main tipple, lump, mine-run and slack; at the re-screening plant, slack, pea, nut and egg. The slack is that portion passing through the ½-in. opening; the pea size drops

through the 2-in. opening; the nut through the 3½-in. screen, and the egg is that product which has passed through the 6-in. screen in the tipple and over the 3½-in. The regular grades may be dumped into their respective bins at the re-screening plant, or the product may be mixed if desired, making not only the four sizes of coal as originally prepared, but a combination of these sizes to meet special market conditions.

The bins into which the coal is screened are made entirely of steel, and are of latest modern construction. In order to prevent any breakage of the coal after having been prepared in the revolving screen, it is conveyed to the bottom, or coal level, in the bin by means of special chutes, constructed as



JEFFREY MOTOR AT THE NEW ACME MINE



ACME CO.'S TIPPLE AND SHERIDAN ELECTRIC LIGHT & POWER CO.'S PLANT

follows: The chute proper is a steel box standing nearly vertical and provided with a series of sloping steel shelves. The coal in passing down the chute pursues a zig-zag course from shelf to shelf, and finally arrives at the coal level in the bin without having dropped at any time, a distance which would cause it to break. This scheme is largely followed in the anthracite territory as being the best method of handling coal with minimum breakage.

Beneath the storage bins, which have a capacity of 500 tons, are three railway tracks, where coal may be loaded from the bin. The mouths of the loading chutes are provided with grizzlies, similar to the equipment at the tipple, for removing slack. At both this point and the tipple, the slack is picked up by screw conveyors, 6 in. in diameter, and delivered to bucket elevators housed in steel, which returns the material to the screens. This eliminates considerable hand labor and keeps the loading tracks free from accumulations of coal.

At the re-screening plant the bins are provided with hoppered chutes over the center track, for loading open cars. The two tracks at the side are equipped with chutes for loading box-cars only. The hoppers over the center tracks are equipped with improved clam-shell delivery gates. The entire plant is operated by electricity, power being secured from the Sheridan Electric & Power Co., whose plant is close to the tipple, as shown in the illustration. Westinghouse, alternating current, 3-phase, 60-cycle motors, having a capacity of 2300 volts are used for driving the tipple and screening plant, one 60-hp. motor being used at each place. The electric locomotives and coal cutters are driven by 250-volt direct current.

MACHINE SHOP

The machine and blacksmith shop is a reinforced concrete building, 40x60 ft., with a steel roof, and equipped with the machinery for making all necessary repairs to cars, mining machines, etc. A side track runs into the shop and over a pit, giving easy access for a man to work under the cars in making small repairs. A steel tank with a capacity of 75,000 gal. on a steel frame 75 ft. high, supplies the miners' cottages, etc.

The tipple, re-screening plant and bridge across the Tongue River are all constructed of steel, resting on heavy concrete pillars. The work was done under contract, by the Ottumwa Box Car Loader Co., of Ottumwa, Iowa. The plant was designed by the manager of the Acme mines, A. K. Craig, of Sheridan, and machinery and equipment has been purchased from a number of manufacturers, it having been his endeavor to secure the best in each particular line.

The Acme No. 3 mine started producing mine-run coal, for railroad use, in February 1911, and during October the new tipple was put in operation. The re-screening plant will go in commission at an early date, and this mine will then be equipped to produce 3000 tons of coal per day—and a coal that will have as good a preparation as any produced in the field.

At this mine Jeffrey mining machines are used exclusively, both breast and longwall types; they are operated by a 250-volt direct current. A Sullivan high speed fan, motor-driven, furnishes the ventilation, the 30-hp. motor on this machine being driven by a 2300-volt, alternating current. Jeffrey electric locomotives are used for haulage. At the present time the camp includes a few temporary shacks, and 20 employes' cottages, completed or under construction; a large building, combining a boarding house, offices, etc., is also being built. As fast as necessary additional dwellings will be erected, and when a store, school, church, etc., are completed the camp will be quite an imposing one. The mine is about one-half mile from the main transcontinental line of the C. B. & Q. R.R., the grade being almost level for this distance.

METHOD OF MINING

In a recent report made by Jno. K. Seifert, the workable coal in the 1100-acre tract of the No. 3 mine, is placed at a thickness of at least 35 ft. This is contained in two seams, the Monarch or upper seam, having 26 ft., 4 in. of workable coal, and the Carney or second seam, about 9 ft. of workable coal. The present openings on this property are made in the Monarch seam, the Carney, which is 42 ft. below, being held in reserve. The workable coal in this track is figured at 38,500,000 tons.

Owing to the thickness of the Monarch seam, the ordinary methods of mining cannot be followed to advantage. There is about 23 ft. of absolutely clean coal in this seam, which can be mined without touching any kind of rock, bone or inferior material. In general it has been found that the room-and-pillar method, driving the rooms 10 to 12 ft. high, and later drawing the pillars, bringing down the roof, gives a high percentage of recovery. The panel system is used, as it is found necessary to stop up abandoned workings, since the disintegrated and dirty coal has a tendency to ignite from spontaneous combustion if left too long exposed to the air.

Manager Craig, of the Acme mines, has devised a system of mining which is about to be patented. He claims for this system a higher recovery of the workable coal in these large seams than

is possible by any of the methods now in use at the various mines. As stated he is about to apply for a patent, having practically completed all of the preliminary work and experimentation.

Mining Conditions

The mines of this district are particularly fortunate in that they have absolute freedom from many of the disadvantages which mark coal operations in other districts. The mines are free from gas, probably due to the fact that the veins are found not far below the surface, while the superimposed strata is largely sandstone or other porous rocks. In mining with a coal roof very little, in fact almost no, trouble is experienced with caves or falls of rock which would injure workmen.

The Acme mine is typical of the district as regards freedom from accidents; during the two years that this mine has been open there has not been a single fatal accident, and no serious accidents of any kind. The freedom from gas makes ventilation a fairly simple problem, in fact the fan equipment at these mines would be totally inadequate were there any gas present. The fans are practically used only for the purpose of blowing out powder smoke.

The one drawback, which is not serious if anticipated and properly guarded against, is danger from fire. The slack coal, especially if mixed with dirt and rock where the roof has come in, in some abandoned room, is very likely to ignite from spontaneous combustion. Knowing this the operators use the panel system of mining, usually running about 30 rooms to a panel. Thus, when a 30-room panel has been worked out, it is only necessary to stop two openings in order to completely close up the section. These stoppings are ordinarily made with concrete.

Analysis of the Coal

The following analyses were made by the Commercial Testing & Engineering Co., Chicago:

Sample top to bottom of 8-ft. seam, Acme No. 1:

Moisture	17.83
Ash	4.11
Volatile matter	58.20
Fixed carbon	19.86
Total	100.00
B.t.u.	9950
Sulphur	0.24

Lower 12 ft. of Monarch seam Acme No. 3:

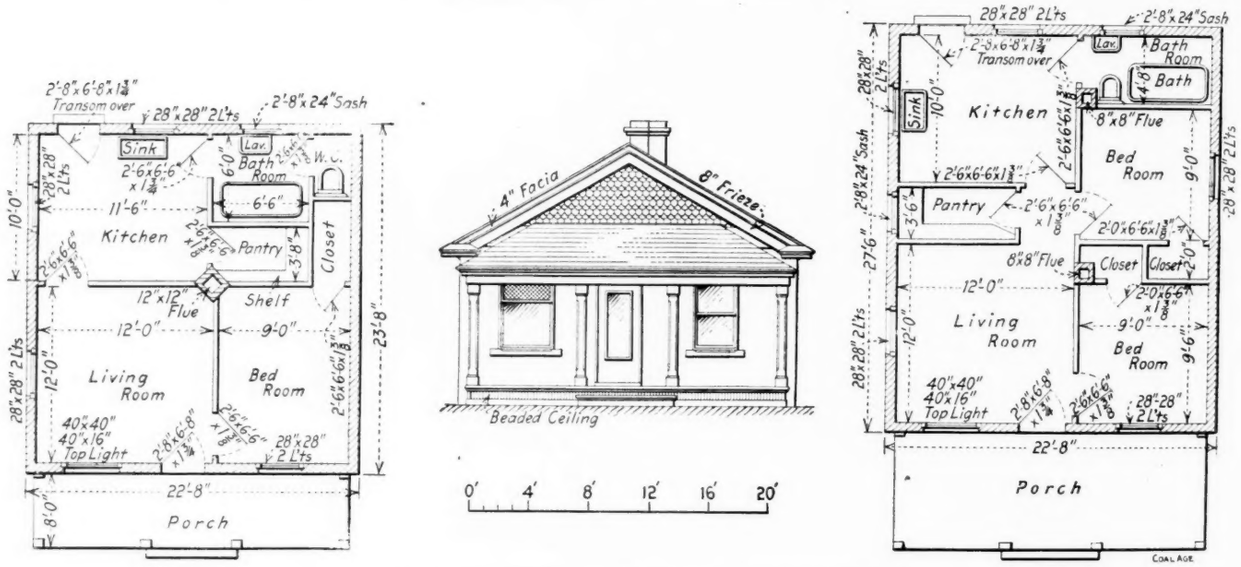
Moisture	17.92
Ash	3.58
Volatile matter	44.81
Fixed carbon	33.69
Total	100.00
B.t.u.	10,247
Sulphur	0.39

This quality of coal would make a splendid fuel for use in gas producers, probably as good, or better than the high class Virginia bituminous coal. These analyses are typical of this section, and when it is considered that this coal is mined absolutely free from foreign material (both the floor and roof being coal) it at once marks this district as unique in the coal industry.

Acme Nos. 1 and 2

The coal from the Acme Nos. 1 and 2 mines is dumped over a single frame tipple; both mines are drifts, with slight inward dips. The coal is mined from the Carney seam, the thickness varying from 9 to 12 ft. Like the Acme No. 3, the room-and-pillar method, combined with the panel system, is used. Rooms are 16 ft. wide and 200 ft. long, leaving 15-ft. pillars. Four Jeffffrey short-wall machines are used for undercutting. The miners drill and blast their own coal, which work, as well as undercutting and loading, is done on a schedule per ton made with the local Miners' Union. These Unions are affiliated with the United Mine Workers.

Two 5-ton Jeffrey electric locomotives are used in bringing the coal from the main partings to the tipple; horses are used in the rooms. The mines are electrically equipped, power at 22,000 volts, 3-phase, 60-cycle, alternating current being obtained from the Sheridan Electric Light & Power Co. This current is stepped down in three, 75-kv.-a., Westinghouse transformers to 2300 volts, and then drives a motor generator set, composed of a 220-hp., Allis-Chalmers motor, direct connected to an Allis-Chalmers, direct current generator, producing at 1130 r.p.m., a 250-volt, 545 ampere current; this current is used for the undercutting machines, locomotives and tipple. In addition to the above equipment, the transformer house contains a small transformer for stepping the current down to 110 volts for the lighting circuit, used both in the mine and town. As at present operated the plant is capable of producing 1000 tons of coal in 8 hours.



Plan and Front Elevation of Three-and Four-room Houses

With the three mines mentioned the Acme Coal Co. is a strong competitor for the business of the Sheridan field and the completion of the plant at No. 3 will place the company in splendid position. The Acme Coal Co. is owned by two men, A. K. Craig and Ora Barnell. The former is the practical miner and the latter the selling head. Both are well qualified for the work they have undertaken, having had long experience in the coal business. To both of them the writer desires to acknowledge the courtesies which have made it possible to secure the data for this article.

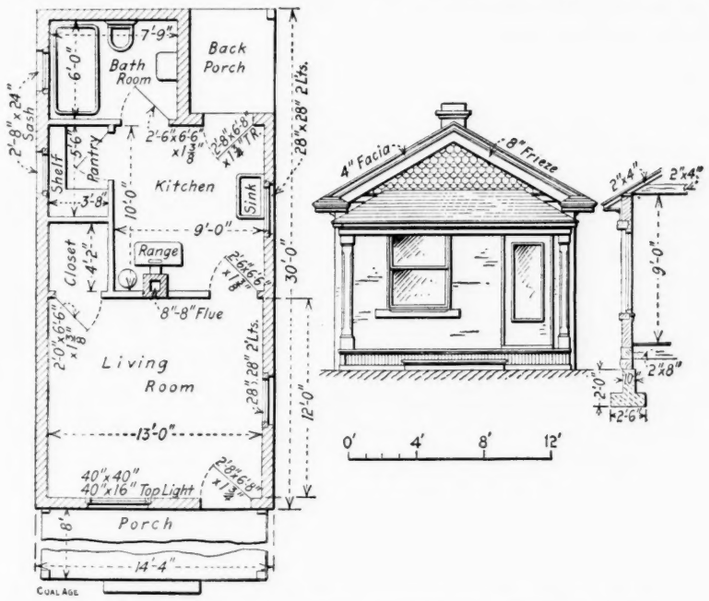
Employees' Residences

In keeping with the equipment of the mine, the company is erecting a group of dwellings for the housing of employees which will bear comparison with those of any mining camp in the country. The plan of house No. 3, which is reproduced herewith, is typical of the village which is being buit. House No. 3, as it is designated in the specifications, has four rooms besides a bath room, pantry and two closets; the conveniences include a front porch extending the width of the building, electric lights, running water, sewer connections and hard pine floors. The extreme dimensions of the outside walls give the house a width of 22 ft., 8 in. and a length of 27 ft., 6 in.

The foundation is of concrete, with two courses of concrete blocks laid above the ground line; upon the foundation, and butting upon the blocks, are laid the floor joists, and upon these the rough floor is spiked and the studding raised. After the studding is raised and the outside weather boarding put on, the inside of the exterior walls is boarded up with rough lumber and into the space thus formed, between the ship lap and sheathing, concrete is poured and well tamped. After the wall thus constructed, and into which pipes carrying the electric wiring have been introduced as the work progresses, the interior rough boarding is removed and the wall pointed up with rich concrete. A coat of alabastine or whitewash completes the interior wall.

Aside from this innovation in construction, the house is completed in the usual workmanlike manner, good plumbing being used, and a heavy coating of paint protecting the woodwork. Partition walls are of the usual construction, 2x4 studding and lath, plastered with two coats and finished hard and smooth. Chimneys rest on concrete piers which extend from the solid ground up to the floor level, taking the weight off the floors. A house of this description rents to an employee for $20. per month, including water, light and coal.

House No. 1 contains two rooms, a living room, 12x13-ft., and a kitchen 9x10-ft., besides a bathroom, pantry and closet. House No. 2 contains three rooms, a living room 12x12-ft., bed room 9x12-ft. and a kitchen 11 ft., 6 in. x12 ft., also a bathroom, pantry and closet.



Plan, Elevation and Partial Section of Two-room House

Power Plant

The Sheridan Electric Light & Power Co. has a most uptodate power plant on land belonging to the Acme Coal Co., having the surface right under a 50-year lease. The location is 9 miles from the city of Sheridan, a place of 10,000 inhabitants, which is served by its pole lines. The coal mines of the Sheridan district are close at hand, the most distant operating mine, the Kooi, being only a little over 3 miles away.

An interurban electric road is building from Sheridan to the coal mines, and has contracted for power generated at this plant. From these details it will be seen that the plant has a convenient location for the generation of power for the city of Sheridan, and is advantageously situated to give service to the mines and electric railway.

The plant is located about 200 ft. from the Acme No. 3 tipple, and it is the intention to install a conveyor for transferring the coal from the tipple to the boiler room of the plant. The boiler room contains three, Heine, water-tube boilers, one of which is being operated under a test with a Roney stoker; should this machine prove successful in the handling of lignite slack, a large field for its use will be opened up. There is demand for a stoker which will fire the slack coal from the Sheridan mines, as dozens of steam plants in Wyoming, South Dakota, Nebraska, etc., are using coal from this field, and a very large proportion of them are using hand firing.

The superheated steam from these boilers is fed to two, Westinghouse-Parsons turbines, direct connected to Westinghouse alternating current generators, which at 3600 r.p.m., produce 1250 kw. of 2300-volt current. Further equipment in the engine room includes transformers which take the 2300-volt current and step it up to 22,000 volts, which is the line pressure. Some of the 2300-volt current is used at the adjoining coal property, and a motor generator set, in the same room, is driven by this current. This set comprises an Allis-Chalmers, 220-hp. motor, actuated by 54 amperes of alternating current, 60-cycle, 3-phase, at 2300 volts, direct connected to an Allis-Chalmers, direct current generator, producing current at 250 volts no load, 275 volts full load, 545 amperes; the set operates at 1130 revolutions per minute.

Exhaust steam from the turbines is taken through a Leblanc condensing system. Water for this system is taken from the Tongue River, on the banks of which the plant is situated.

Annual Banquet of Mine Officials at Pittsburg

Superintendents, mine foremen, assistant foremen and fire bosses of the seventeenth bituminous inspection district of Pennsylvania held their first annual banquet at the Monongahela House, Pittsburg, on Saturday evening, April 13. One hundred and fifty-four mining men of the district were in attendance.

W. H. Pratt was elected toastmaster and with a few appropriate remarks called upon the following, to address the gathering: J. I. Pratt, mine inspector of the seventeenth bituminous district; David Young, mine inspector of the fourteenth bituminous district; J. B. Johnston, editor of the *Coal and Coke Operator;* R. H. Heath of Homestead, Penn.; Hugh Gibbs, inspector for the Pittsburg-Buffalo Co., Canonsburg, Penn.; H. D. Thompson, superintendent of the Pittsburg Coal Co., Willock, Penn.; and Dr. McKnight, of Willock, Penn. David Young, of Freeport and T. A. Jackson, of Curtisville, were invited guests.

It is intended to make these meetings an annual affair and much credit is due John I. Pratt for bringing the mine officials together to discuss various mine problems of the day.

Water Purification for Collieries

Special Correspondence

Water softeners which make use of waste heat, and combined preheaters and softeners are frequently installed. Iron salts require special apparatus for their removal. Aluminum possesses remarkable properties in connection with the softening of water, which are not, as yet, thoroughly understood. The third of a series of articles on water-purifying processes and apparatus.

When water which is possessed of temporary hardness, is boiled or brought near the boiling point, carbonic acid gas is given off and carbonates are precipitated. This treatment suffices if there is no permanent hardness or other impurity to be dealt with but when permanent hardness is present, the water must be chemically treated. In the heater-softener, made by the Eriths' Engineering Co., of London, the use of lime is dispensed with and the arrangemen of the apparatus is as shown in Fig. 1. The supplies of cold water and soda solution are delivered together into a trough near the top of the upright portion of the apparatus, whence the water overflows onto removable trays, and finally falls into the settling chamber. At the same time, exhaust steam is delivered through the oil separator in the upper part of the shell surrounding the trays, and any excess of exhaust steam that there may be, escapes through a vent in the top of the shell.

Steam at atmospheric pressure is capable of heating the water up to about 210 deg. F., and the air and carbonic acid gas in the water are driven off through the vent pipe, a large proportion of the carbonates and precipitates being delivered at the bottom of the settling chamber. Moreover, the soda ash solution, which removes the sulphates, chlorides, and acids, has an accelerated action due to the heat. The water from the settling chamber passes upwards through a horizontal filter.

At the side of the settling tank will be seen a water space in which is located a float for controlling the admission of cold water and soda. The surface of the water in the settling chamber is occasionally flushed over in order to remove the scum due to oil from the oil separator. This is accomplished by admitting an excess of cold water and the portion thus flushed off passes into a trap or water seal. It will be seen that back pressure cannot occur with this arrangement and there is no danger of choking from deposits. The travel of the water after passing over the trays still gives plenty of opportunity for precipitation, and the low cost of soda ash, which is the only reagent used, makes the process inexpensive.

Combined Heater and Softener

The Paterson Engineering Co., Ltd., have a large number of water purification machines working in connection with coal mining plants and the majority of these are arranged for the utilization of exhaust steam from hoisting engines, haulage engines and other steam driven auxiliaries. Fig. 2 shows a type of apparatus in which the supply of hard water is controlled by a float in the feed-pump suction tank and is led through a chemical regulating apparatus, which measures it continuously by means of a narrow vertical discharge weir.

A large float controls the position of two tapered valves discharging the softener reagents. The level of these valves is kept constant by ball cocks connected to the chemical storage tanks. The hard water and reagents are thoroughly mixed in a mixing tray before passing through a water seal into the heating chamber. The exhaust steam passes through a preliminary grease separator (where the oil from the engines is removed) to the heating chamber. Here it passes through the trays in a counter-flow direction, finally escaping to the atmosphere.

The heating trays are constructed of light sheet steel and are easily withdrawn for cleansing purposes. The water falls from the distributing box into the center of the top tray. Owing to the great length of the tray the water overflows the edges in exceedingly thin films, which cling to the underside and drop from the center into the middle of the tray immediately below. After working its way to the edges of the second tray it again overflows onto the underside and drops into the middle of the third tray and so on. By this method exhaust steam comes into contact with the films of water and the temporary hardness is removed without the aid of chemicals, by driving off the carbonic acid gas and precipitating the lime salts.

For the removal of the permanent hardness, sodium carbonate is necessary, and this is added through the Paterson measuring gear in accurate proportion to the amount of water passing. The heated and softened water passes into the precipitating chamber where the bulk of the impurities settle out, final purification being effected by double filtration through wood fiber. One objection to the open-type exhaust heater is the contamination of the feed water by oil. This is overcome in the Paterson apparatus by the addition of sulphate of alumina which coagulates the oil and fine suspended matter into tangible masses, readily arrested by the filtering medium.

Apparatus for Removing Iron Salts

Reference was made in a previous article to the removal of iron salts from mine water. The plant referred to, was an automatic self-cleansing filter erected by Messrs. Royles, Ltd., at the Tyldesley colliery for removing ochre colored impurities due to the presence of iron compounds in the water, a clear effluent resulting. Messrs. Royles have also developed a special type of eliminator for underground waters containing bicarbonate of iron which as soon as it is exposed to air is changed into iron oxide causing the water to assume a reddish brown color. Deposits of such sediments are apt to choke pipes and tubes and water thus affected is hardly suitable for either boiler-feed or for bathing and cleansing purposes. A brief note concerning this iron eliminator will therefore be of interest to colliery engineers who have to deal with this particular form of impurity.

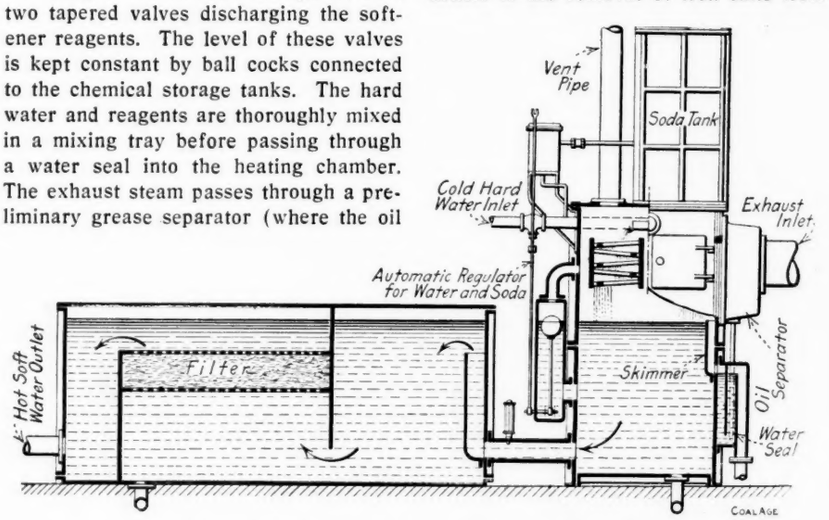


FIG. 1. ERITHS "NO LIME" FEED-WATER PURIFIER

The device is illustrated in Fig. 3 and consists of a spraying tank *A*, coke tower *B*, and a gravel filter which is periodically cleansed by means of air. The untreated water flows into the spraying tank, the bottom of which is perforated with small holes that allow the water to pass through onto the coke bed beneath, in the form of a fine shower. Water and air are thus thoroughly mixed and the absorption of oxygen causes the precipitation of iron oxide. This precipitation is continued throughout the passage of the water in fine streams over the coke, as the sides of the coke tower are perforated to admit more air. A coating of iron oxide speedily covers the coke, and this accelerates the separating action.

From the coke tower, the water passes in the form of a fine shower onto the gravel filter where the iron oxide remaining in suspension is arrested and finally the water is delivered at the point *D* in a purified condition. When the filter has to be cleaned, the mud valve *E* is opened to the drain, and the air blower *F* forces in a supply of air at the same time that water is admitted to the lower side of the filter. Energetic flushing of the filter is then maintained for a few minutes and the muddy water is drawn off through the mud valve.

Remarkable Property of Aluminum

Mention was made also of the remarkable action of aluminum on water, in connection with preventing hard scale in boilers, and some reference should be included to the Neff-Brandes apparatus which has been installed in Kainscht, near Meseritz, Germany. The boiler at this plant, used for driving air-pumping engines, was supplied with water from a ditch running over a neighboring mine. This water was of a particularly hard quality, the scale formed on the boilers being excessive. The Neff-Brandes apparatus, when installed, not only destroyed the adherent boiler scale, leaving in its place a scanty gray powder, the greater part of which was completely removed from the boiler by flushing out, but the pressure of steam was thereafter maintained with ease, and the boiler plates were kept in good condition. Dry steam of a bluish tint was obtained instead of steam having a gray appearance, indicating excessive moisture.

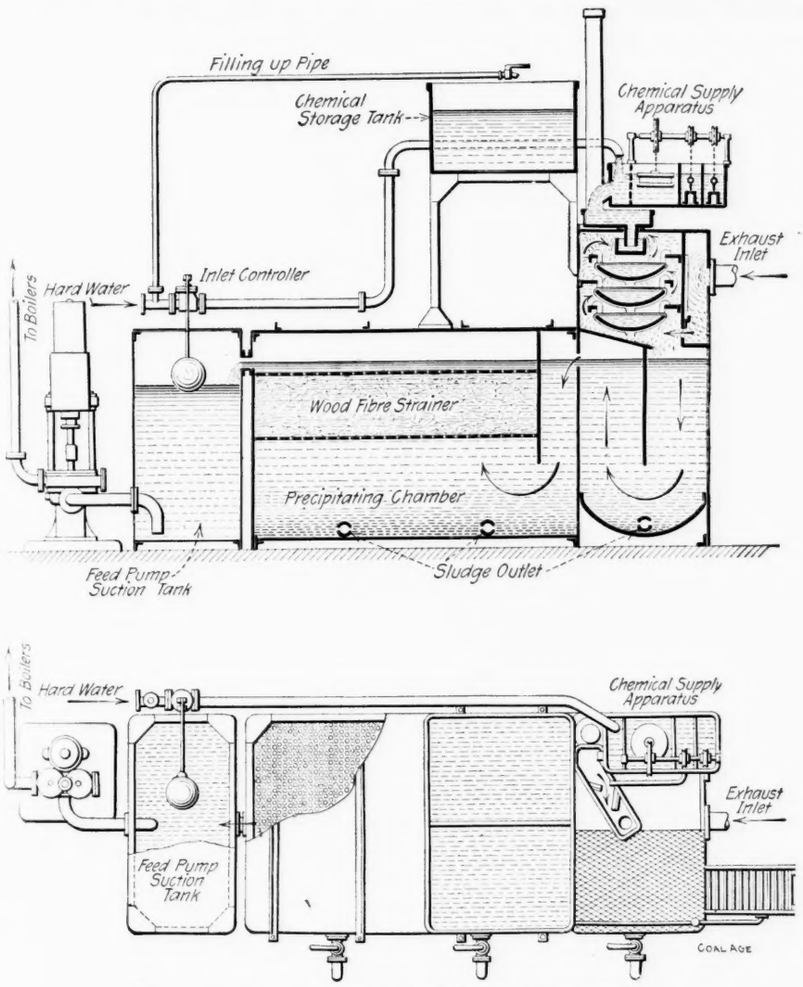


Fig. 2. Combined Purifier and Open-type Heater

The Neff-Brandes apparatus has been brought to England under the name of the "Luminator" treatment. The operation consists solely in running the water down the channels of a steeply inclined corrugated aluminum plate, and the water after this treatment is passed directly into the boilers. No reagents of any sort are added. The action of the process, so far as at present can be determined, is as follows:

The surface of the aluminum plate, being kept clean and active by occasional scrubbing, slowly disintegrates and forms an extremely fine powder of aluminum in the colloidal state. This fine powder is washed off the surface of the plate by the water passing over it at a high velocity and is carried with the feed water into the boiler. In the boiler, these extremely minute metallic particles, which remain in suspension in the water, form nuclei for the evolution of carbonic acid gas and also for the crystalization of the carbonates in the water. This crystalization thus occurs on the aluminum particles instead of on the boiler surfaces and there is finally deposited a soft and non-adherent mud.

When the water contains permanent hardness the effect on the sulphates is not definite. The sulphate crystals form in the ordinary way but are separated from one another by the non-adherent carbonate mud, and are thus prevented from forming a close scale. This is briefly the theory of the operation of the process, although there are undoubtedly other actions occurring which have not yet been fully demonstrated by experiment.

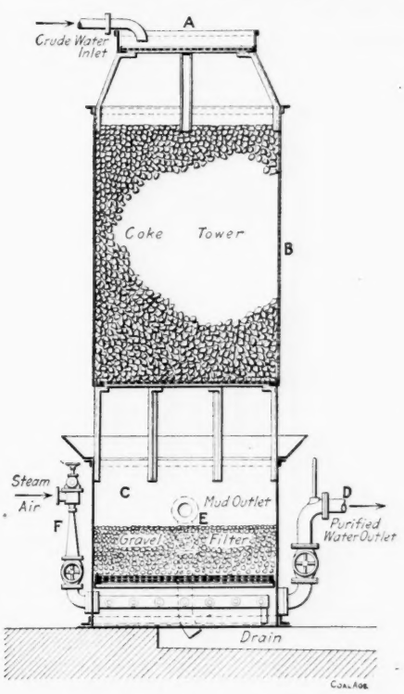


Fig. 3. Iron Eliminator

Review of Iowa Mine Explosions

By R. T. Rhys*

Answers to numerous inquiries received in regard to the Iowa practice of slowing down or stopping the ventilating fan previous to firing shots in coal mines. Brief review of mine explosions in Iowa: First, in mines in which the ventilation was not reduced when firing; and second, in mines where the ventilation was so reduced. Comparative results and conclusions.

*State Mine Inspector, District No. 2, Ottumwa, Iowa.

From the inquiries I have received of late it seems that the Iowa method of slowing down the fan at firing time is receiving considerable attention in other states. In the discussion relative to the advocacy of this method the following questions have been frequently asked:

(1) What is the practice, in Iowa mines, regarding the speed of the fan at firing time?

(2) Has the slowing down of the fan at firing time put a stop to explosions and windy shots in Iowa mines where this practice has been observed?

(3) Does experience in Iowa mines show that the slowing down of the fan at firing time reduces the danger, or the probability that an explosion will occur?

(4) Does experience in Iowa mines show that the slowing down of the fan at firing time lessens the force of an explosion and makes it less destructive should one occur?

My answers to the above questions are deduced from the official reports of Iowa explosions, and from my own personal observation and experience. They are as follows:

(1) The general practice in this state has been for the past several years and is today, in all new mines or mines not extensively developed, to stop or slow down the fan, a little before or at firing time. In practically all our more developed mines, however, the fan is allowed to run at its usual rate of speed; that is to say, there is no change made in the speed of the fan, at firing time.

After the Pekay and Cedar mines explosions the people of our state were in a receptive mood to adopt any practical measure that promised to diminish the danger of an explosion, or make it less destructive should one occur. Some of our leading mining men at the time strongly advocated the slowing down of the fan at firing time as a measure of protection; and, inasmuch as the remedy proposed was an easy one to carry out, entailing no expense to the operator or loss of wages to the miner, it was not long before some mines adopted the plan suggested. By the end of the year 1902 the practice of slowing down the fan at firing time had become quite general throughout the state, and has been adhered to ever since. Whether right or wrong the belief in its protective value is such that it would be almost impossible to secure shotfirers in new mines, especially during the cold season, unless the fan is stopped or slowed down at firing time.

(2) I can positively answer this question by saying that it has not. It is only fair, however, to say that no one, in this state, claims that it does.

(3) To this question I shall not reply either in the affirmative or the negative. I am seeking for and ready to receive proof either for or against the practice in this state. I think I am correct in saying that should I or some one else answer "yes" or "no" to this question it would only be a matter of opinion. No one yet, to my knowledge, has been able to show positive proof that the practice of slowing down the fan at firing time has prevented a single explosion, in this state, or that the practice has caused one.

(4) To compare explosions in Iowa with those in other states, even though there be a similarity of conditions, may often lead to wrong deductions. It seems to me that to arrive at right conclusions, Iowa explosions that have occurred in mines under one practice of ventilation at firing time, should be compared with those that took place in Iowa mines under a reversed practice of ventilation at firing time. In other words, to prove which of these two methods is the best and safest practice, comparisons should be confined to Iowa mines, under the two practices. When we do this the claim that explosions in mines where the fan was kept running at the usual speed and the usual quantity of air was circulating at firing time have exhibited greater force and were more terrific than those that occurred in mines where the fan was stopped or slowed down at firing time becomes a questionable one.

Iowa Mine Explosions, Ventilation Not Reduced When Firing

(a) The first explosion in Iowa, causing loss of life, was in Pekay mine, Nov. 8, 1892, when three men were killed. The official report of this explosion shows that there was evidence of great force. The fan was running to within a few revolutions of its usual speed; and practically the usual current of air was circulating at firing time.

(b) The explosion in the Cedar mine, Feb. 14, 1893, where eight men lost their lives, took place when the usual volume of air was circulating at firing time; and although the number of lives lost was greater than in the Pekay explosion, yet the extent of the explosion was limited and the damage done to the mine was small. All the men killed were on the entry, going home, and were caught by the blast not far from the seat of the explosion.

(c) The Jack-Oak mine explosion took place Nov. 27, 1894, at a time when the usual volume of air was circulating. One person was killed. The area traversed by the explosion was small and practically no damage was done to the mine.

(d) The explosion at Buxton, mine No. 13, took place March 5, 1907. One shotfirer was killed. This mine was an extensive one, and the fan was not slowed down at firing time. The explosion traveled only a short distance and did but small damage.

(e) The explosion at Lockman, mine No. 3, took place Jan. 4, 1910. One shotfirer was badly burnt. The usual current of air was passing at firing time. The extent of the explosion was small and no damage was done to the mine.

I have thus named every explosion of importance recorded in the biennial reports of the state mine inspectors that have occurred in mines where the usual current of air was passing at firing time. From these reports it is plain to the impartial reader that the Pekay explosion was the only one that exhibited evidence of great force. Also, in comparing these explosions it should be remembered that in the Pekay explosion five and one-half kegs of powder were exploded, which added greatly to the force of the explosion. This, everyone must admit, was a great factor in extending the area and augmenting the force of the explosion.

Iowa Mine Explosions, Ventilation Reduced When Firing

I shall now give a list of all the important explosions that have taken place in the mines of this state, where the fan was stopped or slowed down before firing time.

(f) The explosion at Cleveland, mine No. 4, Jan. 5, 1901, when two shotfirers were killed, was marked by evidence of intense heat at the point of origin, and the initial force was great. Large rocks weighing several hundred pounds were picked up and carried quite a distance. The force of this explosion extended out along the main entry to the hoisting shaft through which it ejected dense volumes of smoke and dust to the surface. The fan in this case was running at a slow rate of speed at firing time.

(g) A second explosion occurred at Cleveland, mine No. 4, Feb. 5, 1901. The

two shotfirers were found in an unconscious state by the rescuing party but recovered after being removed to pure air. This explosion originated at a point less than 50 yd. distant from the explosion of Jan. 5. The explosion left scarcely any sign of great heat, and created no unusual disturbance in the vicinity of its origin. Its initial force apparently was less than the first explosion named; but it gathered strength and became more destructive on its way out. Doors and stoppings that the former explosion failed to damage were destroyed by this explosion. A larger volume of smoke and dust was ejected from the hoisting shaft; and, while no life was lost, it was an explosion that exhibited tremendous force much greater than the first one named. The fan in this instance also, had been slowed down at firing time.

(h) The most disastrous mine explosion in the history of Iowa took place at Lost Creek, Jan. 24, 1902. Twenty lives were lost. No explosion in this state has ever exhibited as great a flame as this one. It was a terrific explosion, and yet the fan in this case also was running at a slow rate of speed at firing time.

(i) Two shotfirers lost their lives in the Hocking-mine explosion, Feb. 18, 1902. I am not able to state the extent and the force of this explosion; but am informed that it was the practice, in this mine also, to slow down the fan at firing time.

(j) The explosion at Foster, Jan. 25, 1904, when two shotfirers lost their lives, was a light one, and the force of the explosion was comparatively small. The two shotfirers had undoubtedly erred in the manner of lighting the shots and also in the selection of a proper place of safety. The fan was stopped at firing time.

(k) The fan was stopped at the Dempster mine, when, on Nov. 1, 1906, the force of the blast of an explosion blew both cages up the shaft and against the sheave wheels, killing two men.

(l) The fan was stopped at Buxton, mine No. 15, when one shotfirer was killed by the force of an explosion, Feb. 25, 1910.

(m) At the explosion at the Regal mine, Jan. 15, 1912, when two shotfirers lost their lives, the fan was running at a very slow rate of speed at firing time. While no great damage was done to the mine, yet I doubt if any explosion in this state has showed evidence of a greater force.

This completes the list of all the principal explosions that have taken place, under both practices, in the Iowa mines, from the first serious explosion in 1892, up to the present time. In comparing these explosions I have named, first, those that occurred under one practice, and then those that took place under the opposite practice. I think every unprejudiced reader will agree with me that so far as the records of mine explosions, in Iowa, are concerned, the claim that slowing down the fan at firing time lessens the force of the explosion and makes it less destructive is not sustained, but is decidedly against this theory.

Explosion at Merritt, B. C.

By Chas. Graham*

Mixed lights and a single-entry system sufficiently explain the Merritt explosion. The flame, checked by a lack of fuel in the intake airways, was unable to travel more than a few feet along the right-hand split, with the result that eleven men were saved.

*Superintendent, Nicola Valley Coal & Coke Co., Middlesboro, B. C.

No. 3 Mine, operated by the Diamond Vale Collieries, Ltd., is located about one mile east of the town of Merritt, on the Nicola Valley branch of the Canadian Pacific Ry. The coal seam is about 4 ft. 6 in. thick and contains two bands of rock. The first band, about 12 in. from the floor, is 6 in. thick. The second, about 33 in. above the floor, also measures about 6 inches.

Two slopes have been driven from the outcrop directly to the dip, and at a point 300 ft. down, a left level has been turned off. The bed at this point is dipping at an angle of about 40 deg. About 50 ft. further down, another level has been driven to the right, and still further down a second level to the left has just been started.

The number of men working in the mine was normally only 20 at the time of the explosion, for the mine was not fully developed. Of this number, 18 miners were actually at work on the date of the disaster—six in the first left level, one in the second and the remainder in the right level. The six miners in the left level and the fireboss, who was traveling along the same heading, were killed; all the others escaped.

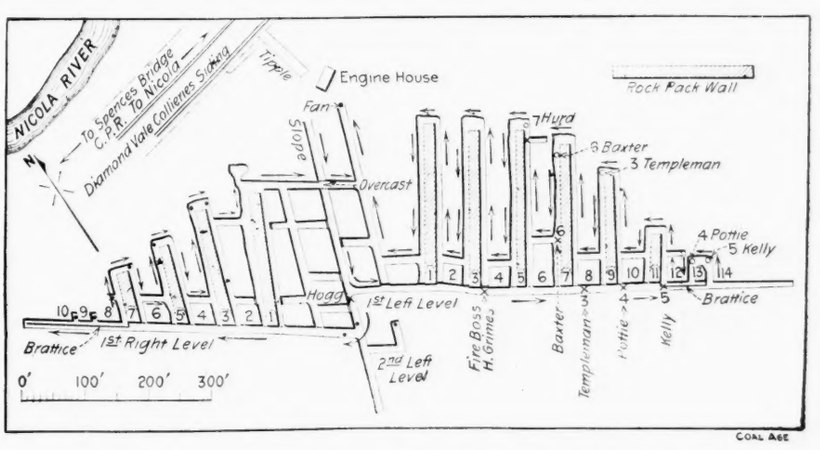
The mine was worked on the room-and-pillar system, with rooms 40 ft. and pillars 36 ft. wide. The room necks were double and about 20 ft. long. The rock from the coal was packed in the center of the room and just filled the space between the chutes, which were built along each rib. The roof is of a hard sandstone, and usually stands without timber.

The Explosion

The explosion occurred at about 9:45 a.m. on the morning of Mar. 7, 1912. A dense cloud of black smoke issued from the mouth of both slopes, and the tipple man, working at the mouth of the haulage slope was blown a short distance by the force of the explosion, but escaped injury. The fan, which was situated in the mouth of the drift, was blown about 25 ft., and the driving belt about 200 ft. The smoke-stack on the boiler was also blown down.

The explosion originated in chutes 13 and 14 of the left level, which were the last openings in this heading. These chutes were connected, but no connection had been made with chute 12. The air was carried by brattice cloth along the level to the mouth of No. 14.

The explosive force generated was not great, and there was little damage done to the mine, the greatest evidence of force being afforded by the action of the



PLAN OF DIAMOND VALE COLLIERY NO. 3, SHOWING WHERE MEN WERE WORKING

fan, which was blown out of the mouth of the return airway. The tops had also been blown off the packs in the rooms.

Cause of the Explosion

Gas had evidently been found in chutes 13 and 14, for the two miners in this room had been provided with safety lamps. These lamps were found hanging on props in their respective chutes. The miners had apparently been using their naked lights on the heading, and one of them had evidently gone up along the chute and taken his naked light with him.

The explosion confined itself to the first left level and the main slope. The flame turned down the main slope toward the right level, for the rope rider and a pusher who were on the siding were severely burned. There is much water on the floor at this point, and the flame did not travel any further. All the men who were working in this level escaped uninjured, with the exception of the two men mentioned. These men recovered from their burns.

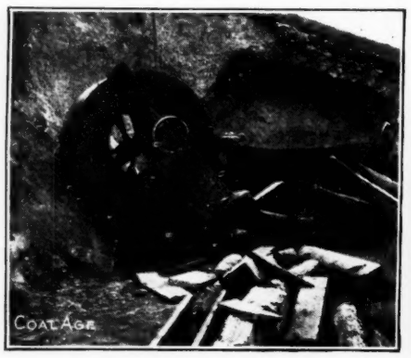
The cause of the explosion was undoubtedly an ignition of the gas in chutes 13 and 14 of the left level by a naked light. The explosion was extended in some degree, however, by coal dust. No powder is used in the mine, but much dust is found, especially in the chutes, due to the breakage of coal as it descends the steep pitch.

Rescue Work

Notice of the explosion was telephoned to the office of the Nicola Valley Coal & Coke Co., at Middlesboro, about two miles distant. I immediately got together a crew of men and loaded the Draeger apparatus on a switch engine. My party was taken over to the Diamond Vale mine. In the meantime, Supt. Browitt, of the Diamond Vale Collieries, Ltd., had gone into the mine and was endeavoring to reach the men. Upon my arrival, Mine Foreman D. Brown, Thomas Archibald, of the Nicola Valley Coal & Coke Co.'s staff, and I went into the mine with the apparatus on. We proceeded along the level and located three of the bodies, the first one being that of H. Grimes, the fireboss.

There was a certain amount of natural ventilation and the level seemed clear. We returned to the slope, took off the apparatus and got together a number of men and went along the left level and brought out four bodies. A fifth was found on the slope below that level. An attempt was made to recover the two remaining bodies up the chutes, but the party was driven back by the afterdamp. Stoppings were repaired temporarily, and it was not until the following afternoon that the remaining bodies were found and brought out. All of the men who escaped, came out of the mine unaided.

In the mine plan, the double lines show where dirt stoppings were erected; single lines, which cross openings, denote curtains. Crosses show where the bodies were found, and the open circles show where the men worked. It is clear that several of them tried to escape after the explosion and fell dead on their way out. The black dots show where those men, who were not killed, were working when the explosion occurred.



Fan Dislodged by Explosion

Main Slope Diamond Vale No. 3

Operation of Diamond Vale Collieries, Ltd.

A cheerful disposition may brighten the day underground even though it cannot bring real sunshine.

Safeguarding the Use of Electricity in Mines

By Hartley M. Phelps*

Investigations of great moment to mine workers and operators, looking to the elimination of explosions, and consequently the saving of human life, are being conducted by the Electrical Section of the Bureau of Mines at its experimental station in Pittsburg. It is known that the results attained so far have been important, although the details have not been made public, as it is the policy of the government not to divulge such information prior to its appearance in the regular bulletins and monographs of the Bureau.

Investigations are being made along the lines of determining the danger of igniting gas by the indicators of inclosed fuses and by incandescent lamps when broken in gaseous atmospheres. Tests are also being made of explosion-proof apparatus and of the insulation of electrical conductors. Furthermore preparations are being made to investigate the action of electric sparks and arcs in the presence of coal dust; the danger of using electricity in the vicinity of explosives; and to make examination of electrical shot-firing devices, and devices for the protection of trolley wires.

According to H. H. Clark, who is in charge of the Electrical Section at Pittsburg, a great many explosions in coal mines are due to electricity, and many more explosions originate from this source in the United States than in England, for instance, where strict legal regulations hedge in the use of electricity in coal mines. Mr. Clark points out that the equipment of mines involves a distinct branch of electrical engineering. The conditions underground are quite different from those on the surface. Not

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only is it here more difficult to install and properly maintain electrical apparatus, but, unless suitable precautions are observed, the presence of such equipment in mines adds danger to a calling already hazardous. In addition, danger to electrical installations comes from falls of roof, coal and rock, and from the fact that acid waters and dampness make insulation difficult. The need of only temporary installations, thus limiting the investment, further adds to the risks to life. Moreover, many mine workers are prone to ignore the rules made for their benefit.

The three principal dangers arising from the use of electricity in mines are: shock, explosions and fires. The chief sources of shock are trolley wires and other bare conductors. Many explosions result from sparks and arcs occurring in an atmosphere of inflammable gas or dust. Sparks big enough to ignite gas are produced when a motor is started rapidly or operated under a heavy load; or when a circuit, carrying current, is opened, or becomes grounded. It requires a much larger spark to ignite bituminous coal dust, but such flashes might be caused by short circuits on conductors carrying a large current, as in the event of a trolley wire falling.

Tests are being made by the bureau to determine how small a flash will ignite gas or coal dust, the temperature of the spark being the crucial factor.

Two Testing Galleries

There are at Pittsburg two galleries for testing electrical equipment in the presence of gas. The smaller is in the laboratory and consists of a boiler-iron box, with connections for admitting gas and air, and having heavy plate-glass observation windows, and openings for relieving the pressure of an explosion. A small motor-driven centrifugal fan mixes the gas and air and causes the mixture to circulate. Devices are installed for determining percentage of gas. In this gallery small sparks and lamps are tested.

The larger testing gallery is a tube designed to simulate a section of mine entry. It is of boiler iron, 30 ft. long and 10 ft. in diameter, and is horizontal, being set in a concrete bed and partly filled with concrete to form a floor upon which apparatus can be set up for tests. Seven and one-half feet from either end, a diaphragm of heavy paper may be inserted to relieve the pressure from an explosion before it becomes dangerously heavy. Entrance to the shell is made through a manhole between the heads. Heavy plate-glass windows are set in the sides of the gallery. A fan mixes the gas and air and an indicator is provided to show the amount of gas present. In this gallery explosion-proof motors and switches and other large apparatus are tested. A special tube is being built for investigating the ignition of coal dust by electricity.

In testing lamps, these are placed in a gas-tight receptacle, filled with a mixture of gas and air combined in proportions most sensitive to ignition. The lamps are lighted and the filaments brought into contact with the gaseous mixture in three ways. First, by smashing the bulbs, thus bringing the mixture in contact with the broken filaments. Second, by snipping off the tips of the bulbs, which usually does not break the filaments, as the velocity of the entering gas is less than in the first method. Third, by puncturing a small hole in the neck of the bulb, which prevents the entering gas from impinging directly upon the filaments, and therefore rarely breaks them.

Explosion-proof motors and switches are tested in much the same way, as it is the flame-proof quality of the casing that is in each instance the point at issue. The atmosphere provided outside the casing is a combination of methane and air most sensitive to ignition.

The experiments relating to the action of acid mine waters upon the insulation of electrical conductors have for their purpose the standardization of methods for future tests. The action of such water is determined by means of insulation-resistance measurements, and by high potential tests.

In making tests of inclosed cartridge fuses in explosive gas, a representative of the manufacturer of the fuse may be present. Those fuses passing the tests are listed for the benefit of the state mine inspectors.

Suggestions and Recommendations

Among the various recommendations made by the Bureau as to installation of electrical equipment may be mentioned the following: All high- and medium-pressure lines and apparatus should be marked at frequent intervals "Danger," and the voltage given. Low-pressure or lighting wires should be marked "Caution," and the voltage stated. Machine terminals should be protected. Lightning arresters should be placed on transmission lines from the generator stations to the mine entrance. High-pressure lines in underground roadways should be lead-covered cables, armored or unarmored. Insulation should be non-hygroscopic and as acid-proof as possible. Trailing cables for portable motors should be especially flexible and well protected. Automatic trolley switches and danger signals should be used.

One important recommendation is: Before any coal-cutter motor is in operation more than a half hour, the mine roof should be examined unless otherwise specified by the mine foreman.

Current and power circuits should not be used for shot-firing. Gaseous mines should be examined daily by firebosses before work is started, the gas to be detected by safety lamps under normal ventilation. If gas is found in dangerous quantities no current should be turned on any circuit for at least 24 hours.

All main cables should be kept away from explosive gases. The switches and fuses should be inclosed in explosion-proof boxes and break under oil. The current-carrying parts of direct-current motors should be surrounded by explosion-proof casings unless the motors are in rooms separately ventilated by intake air. The carrying of tools near wires and the placing of powder near conductors should be prohibited, or guarded against.

The Bureau deplores the absence of uniformity in the installation of electrical equipment in mines, but affirms that the various states are taking a lively interest in an effort to secure suitable regulations, although an admirable set of rules was rejected by the Pennsylvania legislature two years ago.

Coal of Southern Nigeria

In regard to the deposits of coal in Southern Nigeria, West Africa, Consul William J. Yerby reports that the governor, in his recent annual address said that the work of the mineral survey during the year has been concentrated on the further examination of the extensive deposits of coal at Udi, which are found to stretch more than 50 miles to the north of that place. The tests and analyses carried out by the government have proved that the surface samples give results equal to two-thirds that of the best Welsh coal. It is reasonable to expect that if the seams are worked the coal that has not been exposed to the weather will be of still better quality.

The question of the construction of a railway to connect this coal field with the river port of Onitsha is under consideration. It is hoped that sanction for the construction of this line may be given, as the importance of cheap fuel to the two Nigerias is great, their combined railway system being already over 800 miles in length. Besides the railway requirements, there is urgent necessity for coal to supply river and ocean shipping.

The lignite deposits to the west of the Niger are also valuable and in at least one locality vary from 10 to 15 ft. in thickness. The total trade of Southern Nigeria in 1910 exceeded $55,000,000, whereas it was scarcely over $20,000,000 in 1900.

The possibilities of profitable mining and export of coal from the Federated Malay States is referred to favorably by the chief secretary of the government in his annual report, just submitted. The deposits of coal are extensive and convenient, the serious question about the matter being with respect to quality. A satisfactory coal supply in those States would be welcomed by shipping in that portion of the world.

Colliery Mine Car Construction

By A. T. Shurick

This is the first of a series of articles which will appear on this much neglected subject. The present paper discusses the general conditions for determining the proper shapes and sizes, and includes a few preliminary remarks on car wheels. The second installment will follow at an early date.

With the advent of large corporate interests into the coal industry, involving extensive investments and heavy tonnages, the mine-car expense item is being more carefully studied. The attention of trained and capable engineers has been concentrated on this feature, and important strides in the design and construction of cars have been made in the last decade.

As a result of the keen competition existing in the coal industry today, it is not unusual for a difference of one cent per ton in the cost of mining, to determine whether a mine may work, and in reducing operating expenses to a minimum the mine manager will doubtless put his finger on the mine-car expense account first. Not only must this be considered from the standpoint of first cost, but in upkeep as well. The expense, incident to continued oiling, and the wear and tear (an item of particular importance in mine cars) are the first points to consider in the well designed car.

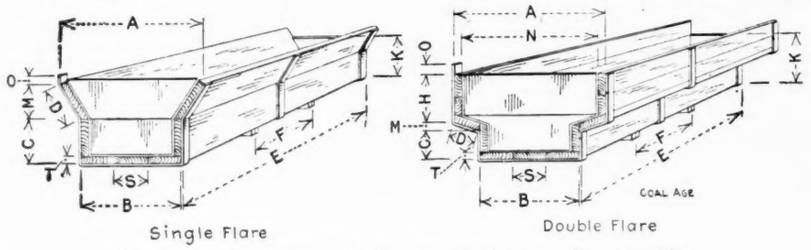


FIG. 1. THE TWO GENERAL SHAPES OF CARS IN COMMON USE

PRELIMINARY CONSIDERATIONS

It is the purpose of this paper to discuss only the composite, frame cars, and to confine the discussion more particularly to the features of interest to the active colliery engineer.

The steel car is coming rapidly to the front and may even in time entirely supersede the wooden car, but that cars of this type have serious disadvantages for work of this character is generally conceded. Thus, for example, the results of a runaway on a heavily pitching slope may be considered with both types of cars. An accident of this kind, on a slope laid with good track, will probably result in the more or less complete destruction of the entire trip, especially if the cars are loaded.

With the wooden car a certain amount of salvage will be possible, as the individual pieces of the iron framework are comparatively easy to recover and reshape. In the case of the steel car the problem will not be so simple, since the average mining plant is not equipped with proper facilities for handling work of this character*.

*For further discussion of this point the reader is referred to Coal Age, p. 379.

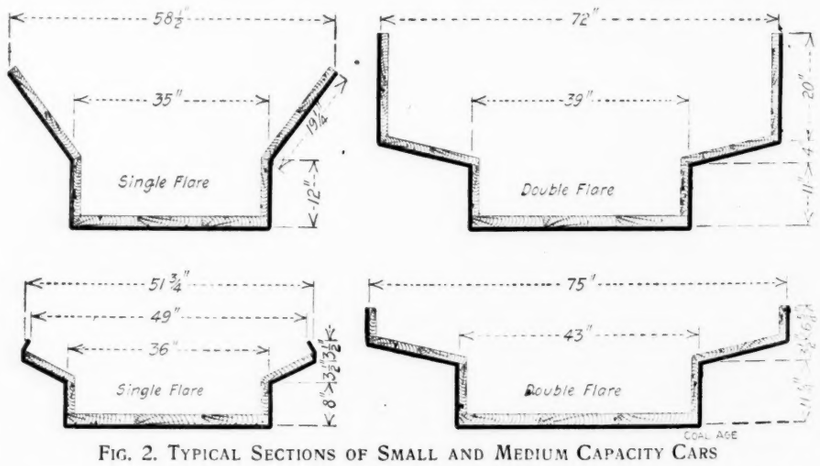


FIG. 2. TYPICAL SECTIONS OF SMALL AND MEDIUM CAPACITY CARS

Rules, formulas, etc., for the proportioning of material, as in machinery design, appear to be entirely unknown here. Many companies design and assemble their own cars, ordering the different irons as required. The ultimate and finally accepted design in such instances is often only arrived at after years of experimenting on the "cut and try" method, but that this eventually gives a thoroughly practical car is hardly to be questioned. A superintendent working along these lines finds for example, only after a number of years, that a certain iron is too light and revises his design accordingly.

That a method such as this would be productive of apparent inconsistencies and freak designs was inevitable. Thus for example may be noted the open derision expressed by a well known mechanical engineer, because of the excessive material (according to his views) used in a coupling at a certain colliery. This coupling had been evolved from 12 years' experience, and had he known the number of wrecks, due to runaway trips, costing from $500 to $1000 each, not to mention the delay to the mine, which had been required to bring about its adoption he would have been less abrupt in his criticism.

SHAPES

The first problem confronting the mine car designer is fixing the general overall dimensions and shape. The shapes may be roughly classified as belonging to one of two types, the single or double-flare, as shown in Fig. 1 herewith. In addition to these there is the square, box type, now confined almost entirely to the anthracite field.

Referring to Fig. 1 the overall width *A* will of course be determined by the minimum widths of the haulageways. The overall length *E* is limited by the track curves and to a certain extent by the wheel-base *F*. The bottom width *B* is dependent entirely on the track gauge and the overall height will be determined by the thickness of the seam.

The choice of the single or double-flare type is mostly a matter of taste and is a subject still open for discussion. There are, however, certain features which should be considered in this connection.

When the seam is high, providing ample head room with no additional cost, the square box type anthracite car may be used to an advantage because of the simplicity of construction. The double-flare type is adapted more practically to a soft, friable coal having few lumps, while with a coal making numerous lumps, these can be used to build up around the sides and ends, thus eliminating the necessity of the extra vertical board.

To one who has ever helped lift a single-

flare car on the track by the usual method of placing the back and shoulders under the flare-board and later tried the same with the double-flare type there will remain no question in his mind as to the superiority of the single-flare car. In addition to this the extra space on the outside of the single-flare car greatly facilitates spragging, particularly in a narrow entry.

Some Typical Cross-sections

The variety of cross-sections for cars is unlimited and selection of the proper shape is governed entirely by the physical conditions of the seam to be worked. Eliminating all designs of a "freak" nature the principle and typical cross-sections of mine cars are given herewith. The examples selected show the maximum and minimum dimensions as to height and width of accepted designs of cars; the designs are in every case of cars which have demonstrated their practicability by a number of years of service.

Two types of low vein cars are shown in the lower part of Fig. 2. On the left is a single-flare car only a little over 4 ft. wide, and with a maximum height of body of but 15 in. This is an extreme exaggeration of this type and may be likened much to the sled used in some parts of Europe for conveying coal along the face to be dumped into the mine car. The flare board comes out nearly flat, completely covering the wheel, which would make spragging difficult, although in a car having such an obviously small capacity as this, the necessity of spragging would not be so urgent.

On the lower right hand side of Fig. 2 is shown a type of low vein car over 6 ft. wide and less than 2 ft. high. This car has an enormous capacity, comparatively speaking as regards low vein cars generally, but would be adaptable only where the best roof conditions prevail. It is of the double-flare type, having a short 6-in. vertical board around the top, which of course adds materially to its carrying capacity. The broad, flat flare of 16 in. on each side would, in this case, prove a very serious hindrance to spragging. The difficulty of providing adequate support for this flare, to insure its retaining its proper shape under the everyday conditions of hard usage around mines, would be another objection. An illustration of a typical low vein car is shown in the accompanying halftone, Fig. 4.

The two upper sections in Fig. 2 are examples of the typical medium sized cars, and an illustration of the same type is shown in the halftone, Fig. 3. On the left of Fig. 2 is shown the single-flare type having a width of nearly 5 ft. and an overall height of body of about 2 ft. 4 in. This section is one of the most popular in use on the medium, or medium-small cars in the bituminous fields. The single flare with its rather acute angle, makes the car easy to sprag and handle under all working conditions, and at the same time adds appreciably to its capacity. On the upper right-hand side is shown a rather large, double-flare car of good capacity. This car has an overall width of 6 ft., and a body height of nearly 3 ft. While the broad, flat flare adds appreciably to the capacity of this car, as already stated, it is much more difficult to handle, for which reason it does not commend itself so readily to the practical man.

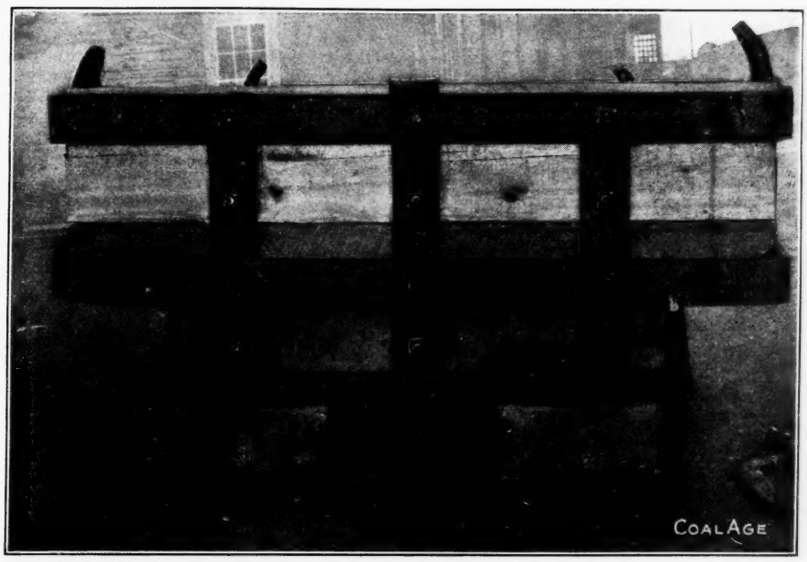


Fig. 4. End View of Low-vein Car, Showing Door

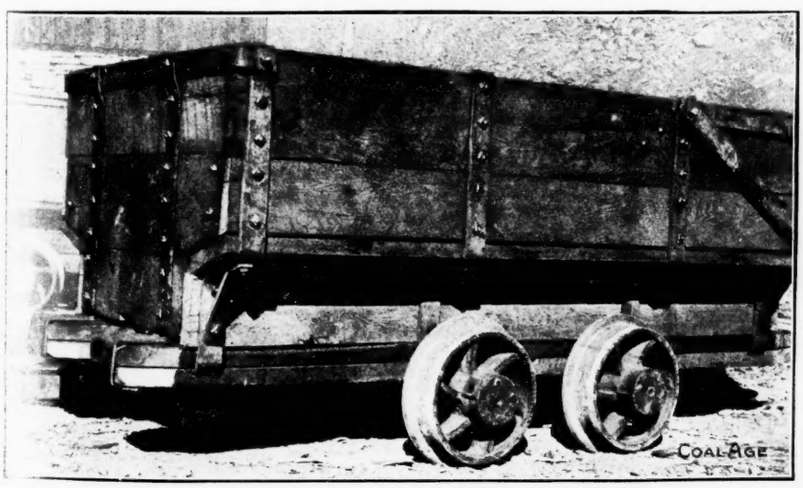


Fig. 3. A Double-flare, Medium Capacity Car

Large Capacity Cars

The larger size bituminous and one of the smaller anthracite cars are shown in Fig. 5. The bituminous types here shown are probably more extensively used than any other class of car, since they are readily adaptable to a 6-ft. or thicker seam, which is probably the average for this country. An illustration of the typical single-flare car of this class is shown in the halftone, Fig. 6. The anthracite operators claim conditions in their mines cannot be compared with the bituminous, and they continue to adhere to the straight box form as shown.

The single-flare bituminous car, shown in Fig. 5, has a maximum width of a trifle less than 4 ft., and a body height of a little over 3 ft. This car has a capacity of 2¼ or more tons of coal, depending on the height to which it is "built up." Larger cars than these are found at times, in fact some districts using them to the exclusion of all others. The opponents to the larger capacity car claim that the difficulty experienced in handling them under the adverse conditions in the mine more than offsets the advantage gained

by the increased tonnage, so this still remains an open question.

The beginning of the flare in these cars may be at any point, providing it is sufficiently high to clear the flange of the wheels, which commonly fit fairly snug against the side of the car. The height should be made such that some commercial size of board will fit, without further trimming, as for instance, 6, 8 or 10 in.; this rule should be followed in the layout of all the straight lines of the bands when it can consistently be done within reason.

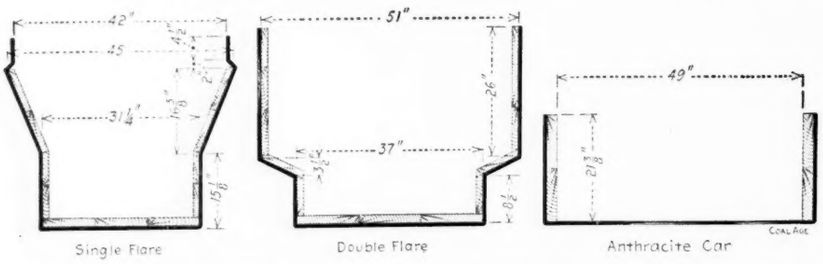


FIG. 5. LARGE CAPACITY BITUMINOUS AND A TYPICAL ANTHRACITE SECTION

CAR WHEELS

The heavy tonnages handled at the modern plants of today necessitate large trips and a comparatively high-speed haulage. In addition to this most of the power required at the mines is usually consumed by the haulage appliances in one form or another. The importance of this subject is, therefore, at once evident, and in no single detail of haulage is it possible to effect greater economies than by the provision of a suitable wheel. This fact has long been appreciated by both the engineer and the manufacturer, and has resulted in a keen competition among the latter until an unusual refinement in design has been attained.

Were it possible to use straight tracks, the mine-car wheel would no doubt be fitted tight to an axle revolving in boxes attached to the car. The sharp curves, essential in all mines, obviously make this impossible since the travel on the outer rail of a curve is so much longer than on the inner that the wheel on the former would have to slide in order to keep up. The advantages of the tight wheel were too great, however, to be completely ignored, and some manufacturers finally evolved the combination tight and loose wheel, thereby overcoming the difficulty due to curves, and making the use of one tight wheel practicable.

But even under these conditions it is still evident that one loose wheel must be used, and since the other presents no difficulties in construction, the discussion of wheels here will be confined entirely to the loose-wheel type.

CAR-WHEEL MATERIAL

The first requisite of a good car wheel is the selection of the proper material, and the manufacturers have attained a high degree of refinement in this respect. To insure the best results the chemical analysis of the iron must be exact. Variations of one-tenth of 1 per cent. in the content of some of the ingredients may entirely ruin the wheel, and since no two carloads of pig iron analyze the same, the purchaser of wheels should investigate this feature thoroughly.

Not only must the chemical analysis of the material be perfect, but the method of casting as well. All wearing surfaces must be hard to insure the wheel having a long life. These hard surfaces are attained by means of "chilled castings," in which the sand in the mold is replaced by iron castings adjoining the surfaces to be chilled, the depth of which latter is regulated by the thickness of the iron. While it is a comparatively simple problem to chill the rims, it is not so easy to accomplish this at the same time in the hub. The chemical reaction of the chilling process embodies simply the intimate combinations of the carbon with the iron, forming iron carbide. The result is a product of such hardness that it will cut glass.

The Mannesman Steel Mine Prop

The Mannesman steel pit prop used in England and on the Continent consists of an outer and inner tube, telescoping within each other. The outer tube is provided with a clamp, which, when loosened, permits drawing out the inner tube to give the required length to the prop. It is then tightened by means of a spanner.

This prop, fitted out with an ordinary cap, is driven into position under the roof with a sledge hammer. It is provided with a ratchet lever and rod by which the clamp is loosened, enabling the miner to withdraw the prop without danger. The safe load for this prop is 16 tons; they neither bend, break or collapse, but in case the load is over 16 tons the prop telescopes until the pressure is removed.

Though the first cost of these props is high, about 30 times that of wooden props, they can, under normal conditions, be used and withdrawn 60 times before repairs are necessary, so that in the end the cost is really about half that of wooden props. The average life of the prop is about five years.

The first cost of steel props is so high that their use at the working face is economical only where every prop is withdrawn and none lost. They are best suited to a moderately hard or strong roof which comes down bodily and breaks in large masses, as this gives a good opportunity for their recovery. They are, however, quite unsuitable for use with a soft, shaly roof, or with fireclay, which breaks easily.

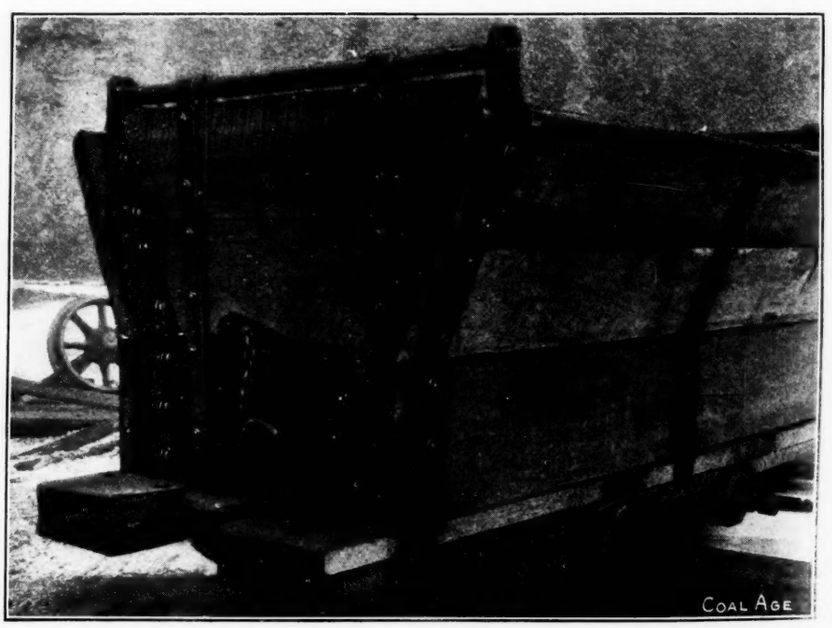


FIG. 6. VIEW OF THE DOOR END OF A MEDIUM OR LARGE CAPACITY BITUMINOUS CAR

Current Coal Literature

The Best Thought Culled from Contemporary Technical Journals, Domestic and Foreign

The Cement Gun

The cement gun has been advocated by mining experts for use in the mines to fill up crevices in the strata and to make a smooth surface on which the coal dust cannot rest. In the French mines several thousands of feet of concreted galleries have been constructed by ordinary methods of concreting. The ease with which they are kept clean of dust is an argument in their favor. But concreting with the use of forms is expensive and the cement gun methods are preferable. It is needless to point out that the cement gun has numberless uses in other building construction around the mines.

The Invention of a Taxidermist

At a meeting of the American Society of Engineering Contractors, William A. Jordan recently gave a description of the machine and its *modus operandi*, from which the following is abstracted:

The cement gun was originally conceived by C. F. Akeley, a taxidermist of Chicago. He desired to build the forms over which the skins of elephants and hippopotami might be stretched.

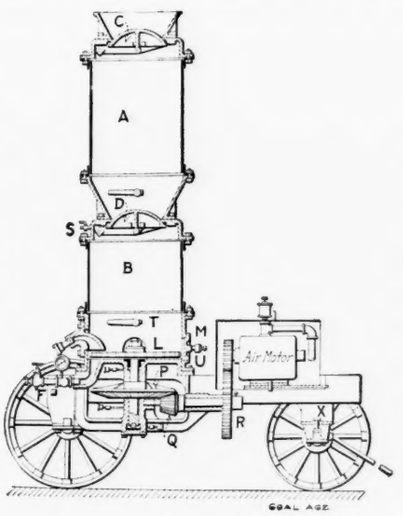
Mr. Akeley was also a member of the Field Museum Committee, and in that capacity sought to remodel and make permanent, one of the old World's Fair buildings in Jackson Park, Chicago, which had been presented to the Field Museum Association. An appropriation of modest proportions had been made for that purpose, and Mr. Akeley conceived the brilliant idea of remodelling the cement gun for that purpose.

Manner of Operation

The gun consists essentially of a hopper *A* into which the dry mixed materials to be used are introduced, through a valve *C*. This valve is closed and compressed air is admitted. Then the valve *D* is opened, and the material drops into the cylinder *B*. The use of the second cylinder is simply for the purpose of permitting continuous action. An air motor shown in the front of the wagon drives a feed-wheel *L* through the intermediate gears *R*, *Q* and *P*. Through the pipe *F* air is admitted which blowing through the feed-wheel at a pressure of 35 lb. per sq.in. carries the mixture through a flexible rubber hose which may be as long as 200 ft. The exit from the machine is by way of the goose-neck over the axle of the rear wagon-wheels. The mixed materials are perfectly dry and not wetted until they reach the nozzle held in the hand of the operator. A separate hose carries water to the nozzle at a pressure somewhat greater than that which propels the mixture. The water in the form of a fine spray mixes with the cement so that it issues from the gun ready for deposition and traveling at a speed of 300 ft. per sec.

Greater Strength and Adherence, Less Permeability and Porosity

The velocity at which the mixture is propelled serves several purposes. It is



The Cement Gun for Concreting

sufficiently great that all unnecessary water is driven out. The pressure assures that the concrete will be deposited compactly and hence, with the minimum of porosity. It is not remarkable then that its permeability varies from three-quarters to one-eighth that of hand-made concrete and that the latter will absorb from 1.4 to 5.3 times as much water.

Any sand which is not coated with cement rolls off the surface and hence does not remain to weaken the aggregate, and this fact together with the greater density explains why the cement gun gives a coating of cement concrete from 1.2 to 3.6 times as strong in tension as hand-made mixtures of the same constituents. In compression the ratio of strength of gun-mixed to hand-mixed mortar vary from 1.2 to 8.2. The gun-work is relatively more successful in depositing the less rich mixtures of concrete. The voids in gun-made concrete are volumetrically 0.52 to 0.75 of those in the hand plastered material; the adhesive strength is from 1.01 to 1.42 times as great. So that the use of the cement gun is not only a cheap and quick way of coating surfaces, but also assures a coat of unusual strength in proportion to the cement used.

It may be added that the cement gun is manufactured by the General Cement Products Company of 30 Church St., New York City. In the cement work of the Woolworth Building as much as 417 cu.ft. have been deposited with a double nozzle gun in an 8-hour day despite some delays in moving the machine about the building.

Men Versus "Melons"

The president of the Plymouth Coal Co., John Haddock, has addressed a letter to the anthracite operators, of which the following is an abstract:

We believe and contend that a just and reasonable reduction of existing trans portation rates for anthracite would enable the coal companies controlled by railroads to increase the wages paid to their employees without advancing the prices on prepared sizes. Nor would the wage increase work any hardship on the independent operators, if a corresponding advance were made in the unduly small proportion of the selling price now ascribed to them.

The existing rates of transportation are notoriously exorbitant. These rates are so excessive that the Reading mining operations, with a large annual production, with a great variety of anthracite, with an advantageous and profitable market, both local and coastwise, with operations which are managed with conspicuous skill and ability, and we believe with absolute honesty, showed during the period of six months a mining profit of 3c. a ton! Surely the patient mining Peter might ask and demand that the opulent transportation Paul give him a square deal. Poor Peter has spent many years of his life raising "melons" for Paul, and now in his later days he and his neighbors would like for the future to receive as adequate compensation a small slice of the luscious "melons," which are a result of his enterprise and industry.

How Bookkeeping Makes Profits

By the excessive transportation charges mentioned, practically the entire earnings of a subsidiary company have been con-

fiscated, the unjustifiable charges of the railroad for carriage of the coal being regarded as a primary and paramount obligation. But this method of bookkeeping might well be looked upon as a device of no public interest or concern, did it not have a far-reaching influence on the independent operator. Unfortunately for him, the arbitrary ratio assumed to exist between producing and shipping costs is made to apply to his coal, and it is therefore pertinent for him to consider the justice of transportation rates.

On this very point we have a recent authoritative opinion of the Interstate Commerce Commission. It reads as follows:

It requires no extended argument to sustain the proposition that the maintenance of an unreasonably high rate operates to the advantage of the Lehigh Valley R.R. Co. as a dealer in coal. The record shows that the only line of demarcation between the Lehigh Valley R.R. Co. and the Lehigh Valley Coal Co. is one of bookkeeping. Assuming for the purposes of illustration that the cost of mining anthracite coal is $2 per ton and the cost of carrying it to tidewater is $1 per ton, it follows that the cost of coal at tidewater would be $3 per ton; and if the published rate were $1 the independent operator and the railroad coal company would be on a fair competitive basis, so far as the cost of mining and transportation are concerned. But as between the railroad company and its coal company, it matters not whether the profit comes from mining or transporting the coal.

So, therefore, if, instead of the $1 rate above mentioned the railroad company were to establish a rate of $1.50 per ton, the railroad and its coal company could still sell at tidewater for $3 per ton, standing a deficit of 50c. per ton in the mining price and taking an equal profit in the transportation price. But the independent operator cannot recoup himself in this manner, and the best price that he could make at tidewater would necessarily be the mining price of $2, plus the carrying charge of $1.50, or $3.50; and he would enter the market at a disadvantage of 50c. per ton as compared with the railroad and its coal company.

It is obvious that such an advantage would enable the railroad company and its alter ego, the coal company, to monopolize the field of production and the selling market. Whatever the means employed, it is a fact that the railroad coal company has monopolized the coal field served by it. In 1901, 47 per cent. of the defendant's coal tonnage to Perth Amboy was controlled by it and 53 per cent. by independent operators; while in 1908 the defendant controlled 95 per cent. of the anthracite tonnage over defendant's line to Perth Amboy and the independent operators 5 per cent.

The Life of the Hard Coal Industry

The exhaustion of the anthracite coal supply was offered by the Lehigh Valley R.R. Co. to justify maintenance of the then existing transportation rates to tidewater. On this point, the commission says:

As to the kindred subject, namely, the exhaustion of anthracite coal supply, counsel in their brief thus state the result of the testimony of W. F. Dodge, an expert mining engineer, introduced as a witness on behalf of the defendant:

"The total future shipments from the Wyoming Division, starting with the year 1909, will amount to 91,230,000 tons. The lives of the various collieries will vary from 5 to 50 years. The annual output is estimated for the first five years to be 19,395,000 tons, and will diminish gradually until from the 25th to the 30th year, the annual output is estimated at only 7,055,000 tons, dwindling down in the period between the 45th and 50th years to 500,000 tons per annum. At the end of 25 years, according to the testimony of Mr. Dodge, the output of the Wyoming region will be less than half what it is now, and at the end of 50 years will cease altogether.

On the other hand, the following more optimistic view of the situation appears from the report of the Anthracite Coal Strike Commission, rendered to the President of the United States, Mar. 18, 1903, viz.:

What is of some importance, however, in connection with the discussion of the past production is a consideration of what is to be expected in the future in the way of production and the probable duration of the anthracite coal supply. The original deposits of the anthracite coal field have been ascertained with a reasonable degree of accuracy.

According to the estimate of the Pennsylvania geological survey, the amount of workable anthracite coal originally in the ground was 19,500,000,000 tons. The production to the close of 1901, as previously stated, amounted to 1,350,000,000 tons, which would indicate that there remained still available a total of 18,150,000,000 tons. Unfortunately, however, for every ton of coal mined and marketed 1½ tons, approximately, are either wasted or left in the ground as pillars for the protection of the workings, so that the actual yield of the beds is only about 40 per cent. of the contents. Upon this basis the exhaustion to date has amounted to 3,375,000,000 tons. Deducting this from the original deposits, the amount of anthracite remaining in the ground at the close of 1901 is found to be, approximately, 16,125,000,000. Upon the basis of 40 per cent. recovery, this would yield 6,450,000,000 long tons. The total production in 1901 was 60,242,560 long tons. If this rate of production were to continue steadily, the field would become exhausted in just about 100 years.

Mr. Wm. Griffith, in a series of articles contributed to the "Bond Record" in 1896, considers that the estimates upon which the foregoing computations have been made were too liberal. His estimate of the amount of minable coal remaining at the close of 1895 was 5,073,786,750 tons.

In the six years from 1896 to 1901, inclusive, the production has been, approximately, 308,570,000 tons, which would leave still available for mining 4,765,216,750 tons. This supply, at the rate of production of 1901, would last a little less than 80 years. If we can assume the annual production will have reached its maximum limit at between 60,000,000 and 75,000,000 tons, and that the production will then fall off as gradually as it increased, we may expect anthracite mining to continue for a period of from 200 to 250 years.—(Report of Anthracite Coal Commission.)

Defendant claims the right, to earn enough out of its coal rates to provide for a return of the principal of the investment in that part of the railroad company devoted to the carriage of coal, when and as this principal becomes reduced and extinguished by exhaustion of the coal. We have noted the estimate of defendant's witnesses to the effect that shipments of anthracite coal over the railroad will practically cease in 50 years, and we have quoted the opinion expressed on the same subject by the Anthracite Coal Strike Commission to the effect that production may last for 250 years. Probably the truth lies somewhere between the two extremes. During the years 1903 and 1910, the Lehigh Valley R.R. Co., under the rates in controversy, succeeded in accumulating an unappropriated surplus of $27,219,780. If the company could accumulate this sum for every eight-year period during the next 30 or 40 years, it would have a surplus in the neighborhood of $125,000,000. It seems, therefore, that the present rates are more than required to meet defendant's conception of what constitutes an annual income sufficient to provide for the return of the capital when that part of the railroad devoted to the carriage of anthracite coal loses its earning capacity through the exhaustion of that commodity.

Tidewater Freight Rates

As to the *cost* of carrying coal to tidewater, in this same opinion, reference is made to the testimony of the officers of Coxe Bros. & Co. and the Delaware, Susquehanna & Schuylkill R.R.—the "Coxe" road.

Prior to the sale of the interests of Coxe Bros. & Co. to the Lehigh Valley R.R. Co., the former owned and operated the Delaware, Susquehanna & Schuylkill, a road about 28 miles in length, which reached their different collieries and connected with the Lehigh Valley R.R. They had trackage contracts with the "Valley" covering the delivery of coal to tidewater.

The testimony of Mr. Pennington, superintendent of motive power, showed that the cost of moving coal to Perth Amboy, in cars of 100,000 lb. capacity, from the Coxe collieries, was 62.41c. per ton, which figure includes not only the return of empty cars to the mines, but also the profit of the Lehigh Valley R.R. Co. on its trackage charge and the profit in shipping of 12c. a ton at Perth Amboy.

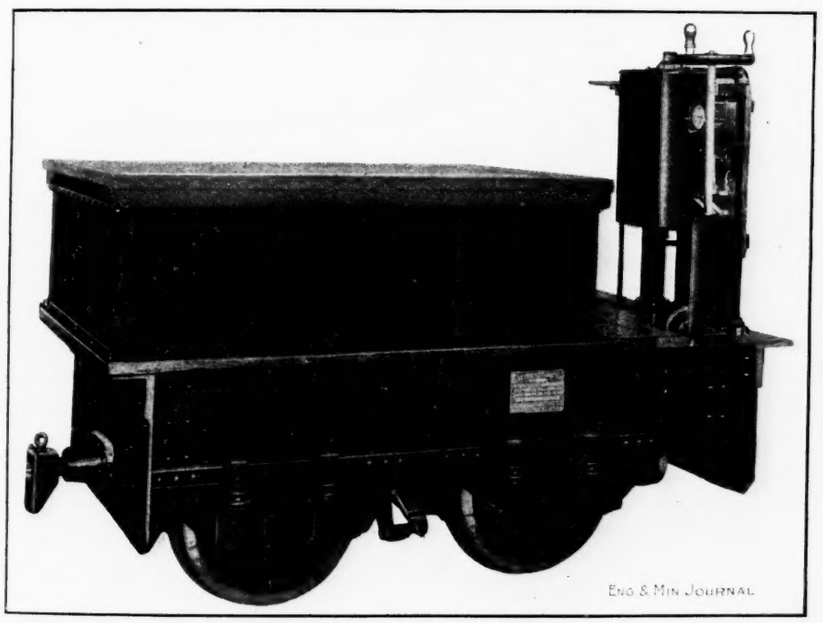
Profitable Losses

Certainly, this *cost* of 62c., as related to the *charge* of $1.55, the tariff on prepared sizes of anthracite, might and does suggest a large and fertile "melon" patch. In the efforts to combat this testimony, the Lehigh Valley R.R. Co. tried to show that the average cost of carrying anthracite from the Wyoming region to Perth Amboy was $1.49. An exhibit filed by this company shows that its average receipts per gross ton of anthracite at Perth Amboy for the ten years ending June 30, 1908, were $1.46. Its business under that testimony, during that period would show a loss of 3c. a ton, yet at the close of its fiscal year in 1908 the "Valley" had a surplus available for distribution of $20,722,871. After making certain deductions for dividends, improvements, sinking fund, etc., there was left an unappropriated balance of $16,516,904. At the close of its fiscal year in 1910, this unappropriated balance amounted to $27,219,780.

"Alice in Wonderland" might suggest that if the loss in carrying anthracite had been 6c. a ton instead of 3c., the "Valley" might have increased, if not doubled its surplus!

Storage Battery Electric Locomotives for Tunnel Haulage

Industrial storage-battery electric locomotives, designed for carrying the load on the locomotive itself, have been on the market some few years, but the pioneer locomotives of the storage-battery type, which are built for hauling trailing loads in tunnel work, have only recently been put into service. They are now being used in the New York aqueduct, which is being constructed for conveying the Catskill water supply into the city. Locomotives impelled by storage batteries, find application at present specifically for short-distance hauls at low speds, where it would not be possible or feasible to install the trolley system, as, for instance, over industrial tracks in and around factory buildings, or in places where continual changing of the trolley could not be avoided.



STORAGE-BATTERY ELECTRIC LOCOMOTIVE

The section of the aqueduct tunnel in which these locomotives operate is about 11 ft. in diameter, concrete lined, and is being driven through solid rock from 250 to 300 ft. below the street level. A series of six shafts has been sunk, each approximately a mile apart, for expeditious operation, and the excavated material is transported to the mouths of the shafts on cars drawn by the locomotives, whence it is hoisted to the surface. Thus each locomotive has a maximum load haul of a half a mile per trip.

Smith, Hauser, Locher & Co., who are executing this contract for the city, recently placed in operation six storage battery electric haulage locomotives, manufactured by the General Electric Co., and have just ordered six additional locomotives. Trolley locomotives were out of the question because the tunnel headings would not permit their entrance. The operation of the locomotives employed has proved efficient and economical, and has permitted laying the tracks without filling, which hauling by mules would have required.

Locomotive Construction and Equipment

The locomotives in use are illustrated in Fig. 1 and conform to the following specifications:

Type of motor (single motor)	G.E.-1022
Diameter wheels	22 in.
Wheel base	36 in.
Total weight	7500 lb.
Length overall	7 ft. 10 in.
Height over batteries	4 ft.
Track gage	30 in.
Speed at rated T. E.	5 m. p. hr.

The batteries are of the 44-cell, 21-plate type and have a 45-amp. six-hour discharge capacity. The locomotives are equipped with an ampere-hour meter, headlight and gong.

Latest modern practice has been followed in the mechanical design. The frame consists of two steel channel sides and steel-plate ends carefully fitted at the joints and held rigidly together with bolts and steel angles. A coupler suitable to the type of cars employed is attached at the rear end. Cast-steel pedestal jaws, which carry the journal boxes, are bolted to the lower web of the channel-side frames.

Automobile Type Motor

The motor used is of the automobile type, designed especially to operate from batteries, and has characteristics that effect the maximum possible economy in the use of battery current. It has high efficiency, large overload capacity and practically sparkless commutation. The motor is compactly designed, yet readily accessible for inspection and repair. It is dust and moisture proof, and is mounted in a cast-steel suspension cradle, one side of which is supported on bearings on the axle, while the other side is spring-suspended from the locomotive frame, in accordance with standard locomotive practice.

The motor drives the rear axle through double-reduction gearing, and an intermediate shaft, supported in the bearing housing, which is cast integral with the suspension cradle, carries the intermediate gearing. As slow-speed service is ordinarily required of a storage-battery locomotive, the use of double-reduction gearing permits such speeds without undue losses in the rheostat, and, because of the large gear reduction from the armature shaft to the wheel tread, high tractive efforts are obtained at comparatively small current inputs to the motor.

Combating Miners' Diseases

The following is an advance extract from the report of the director of the Bureau of Mines, for the fiscal year ending June 30, 1911:

"An arrangement has been made with the Public Health and Marine-Hospital Service by which one or more surgeons connected with that service will carry on jointly for that service and for the Bureau of Mines investigations looking to the improvement of mine conditions. These inquiries and investigations have already shown the prevalence of tuberculosis and hookworm as miners' diseases in a number of different localities in the United States. It is important that this work should be extended more rapidly, because of the fact that the health conditions, as well as the risk of accidents, may be influenced by conditions susceptible of easy improvement. Furthermore, the large and continuous influx of foreigners into the mining regions of the United States will bring to an increasing extent the hookworm and other diseases that abound in mines in parts of certain European countries.

"Various questions that concern the health of workers in mines, quarries and metallurgical plants cannot be answered finally without investigations and inquiries that are national in scope. Among such questions are the most efficient methods of preventing the diseases peculiar to certain industries, the most effective sanitary precautions to be observed in and about coal mines and metal mines, and the relative healthfulness of occupations pertaining to mining and metallurgical industries. The investigations and inquiries that are essential to the gathering of reliable information on these questions can be undertaken by the Bureau of Mines, in connection with its collection of accident statistics, in a prompt and efficient manner and at minimum expense."

Who's Who—in Coal Mining

Devoted to Brief Sketches of Prominent Men, Their Work and Ideas

All of the recent advances in coal-mining practice haven't been effected by time-worn Methuselahs with gray beards, false teeth and furrowed brows. A whole raft of sane ideas, new theories and improved methods have originated in the fertile minds of the "second generation."

Time was when a man had to lose his hair, contract rheumatism and be granddaddy to half a dozen humans before he could hope for recognition as a competent and practical mine engineer, but we have come to realize that ability to sit tight in a canoe and drift with the current is not as great a virtue as being able to paddle straight to the desired landing. Results accomplished merit greater approbation than time consumed.

No young man engaged in coal mining today has traveled faster or been of greater benefit to the industry than Harry M. Warren, electrical engineer for the Delaware, Lackawanna & Western company. He handles electricity like a Southern darky does a watermelon—goes to the center first, and then eats his way out. Some day, not so far distant, the D. L. & W. won't need anybody in the coal department but Harry, for he will be able to throw on a switch, which will be all that is necessary to mine, prepare and ship his company's coal to tidewater.

Mr. Warren was born in Worcester, Mass., in 1875. Graduated from the Worcester Polytechnic Institute in 1896, taking a P. G. in '97. Following his graduation from college, "H. M." started in contracting work at Montclair, N. J., changing from this work a few months later to the testing department of the General Electric Co., Schenectady, N. Y. On leaving the General Electric, in 1900, Mr. Warren was made electrical engineer for the D. L. & W. Co., and he and they have stuck together like a porous plaster on a lame back.

When Mr. Warren took up coal mining 12 years ago, there wasn't much electricity used in or about the collieries. Some of the companies employed main haulage locomotives, but there were no gathering motors in use. A number of mines had electric hoists on slopes and planes underground, but no electric hoists at shafts. Electric plunger pumps were about the only style used, and there was no electric power in the breakers. Practically all the current was "direct," and power was generated by engine-driven generators at each individual colliery.

One of the earliest and most important developments of the past decade was the

HARRY M. WARREN

gathering locomotive. Following close on this improvement came centrifugal pumps. Concerning the latter, Mr. Warren is an ardent advocate of this style of pump in all cases where large bodies of water have to be handled, and this recommendation he makes regardless of head. Bronze pumps are his choice when bad water is encountered, and it is his idea that the best way to use centrifugal pumps, on a slope, for instance, is to operate them in series, placing the pumps at intervals, so that each will operate on a 100-ft. head. He says that when a centrifugal pump falls down in the handling of a large quantity of water, its failure is due, in nearly every case, to the machine being of improper design. The advantages of centrifugal pumps are their ease of handling, and the fact that they can be placed in a cramped space.

Both direct and alternating current are used to drive pumps, but Mr. Warren recommends the latter for station pumps, because, (1) it permits the use of high voltage; (2) gives advantages of an induction motor; (3) eliminates trouble from variation in speed. He suggests the use of direct current for movable pumps.

Mr. Warren says that his company at present is operating a large number of hoists driven by alternating-current motors. The present maximum capacity of these hoists is 200 hp., but he is firm in the belief that before very long, similar equipments of 600 hp. will be installed. As to the advantages of alternating-current over direct-current hoists, he says that the chief advantage is in the transmission of power, especially as to the size and cost of wire.

One of the most interesting of Mr. Warren's views is in reference to the use of electric hoists for shafts. He believes that it does not pay to operate a shaft hoisting equipment by electricity, when the shaft is located at a colliery where a boiler plant is necessary for other purposes. This is particularly true if the exhaust steam can be used to advantage in a low-pressure turbine, or otherwise be utilized. Although a steam hoist is less efficient than an electrically operated plant would be, the initial cost of a steam operated installation is so much less than for an electrical hoisting-station equipment that the initial saving is sufficient to overbalance any reduction in operation charges that results from the use of an electric hoist.

In this connection, it is necessary to remember that at all anthracite collieries, where the coal has to travel through a breaker, a boiler plant is required to supply heat in the breaker, and to keep the water that is used in preparation of the coal from freezing. All the saving from an electrical equipment results from economy in the use of coal, and, therefore, the higher the price of coal, the more favorable is the proposition to the use of electricity. "H. M." is ready to concede that the electric hoist permits better control and occupies less space.

In breakers, he advocates the use of motors because, (1) they eliminate countershafts, pulleys, belts and ropes; (2) afford greater flexibility, in that each individual equipment can be located with reference to any other part, insofar as the drive is concerned.

In conclusion, "Harry M." believes that all power used in a mine, where practicable, should be electric power. He suggests, however, that the poor steam economy at most collieries is due principally to the losses from radiation and drips when the equipment is not in operation. The ability to burn small sizes of coal at a high rate of combustion has recently been given much attention by his department, with the result that today he finds it possible to burn barley coal and develop at least 60 per cent. over-rating, while a few years ago it was difficult to operate normal rating with the same grade of fuel.

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CIRCULATION STATEMENT

Of this issue of Coal Age, we will print 7500 copies. No copies will be sent free regularly. There will be no back numbers. The figures shown here each week represent live, net circulation.

This journal has a direct aim—a single purpose—which is to help advance the coal-mining industry. Its creed embodies the dissemination of knowledge and the free interchange of ideas among its readers, all of whom are invited to become regular contributors.

Contents

COAL AGE

The Leaders and the Led

Rapid changes have taken place in the anthracite strike since the members of the joint committee appointed by the United Mine Workers refused to accept the settlement of the subcommittee. As that smaller body was not invested by either party with plenary powers to effect a settlement, it is easy to understand why the larger body felt justified in refusing to accept it.

Yet it must be remembered that the members of the subcommittee while meeting behind closed doors had plenty of opportunity to confer with their confrères, and doubtless did so during every recess. The events showed that the body of mine workers refused to stand back of their representatives and abide by their decisions. Nevertheless, it must be admitted that the remarks of George F. Baer were undiplomatic, and it was not well advised to hold the joint committee to any other action than that to which they stood committed by the words of their reference.

On the other hand, the miners will have to learn that they must give plenipotentiary powers to their executive officers. No success can attend them if all their *pourparlers* are mere waste of time, and some irritability in the opposing parties with whom they thus treat so irresponsibly is but natural under the circumstances. We do not think that the operators have acted wisely in attempting to load even a small quantity of coal while the opportunity to settle the strike is still so favorable. Such attempts can only irritate the men.

The English-speaking miners have shown a desire for peaceable methods. The rioting up to date has been confined almost entirely to the Southern fields, where foreign labor predominates. The Northern district, which is inhabited principally by Americans, has preserved the peace, except in one or two localities. The English-speaking miners have shown a politic disposition and view with no little regret that the foreign element is pursuing un-American methods of settling the dispute, and injuring the instruments by which their livelihood is secured.

We think that the operators cannot accede further demands without weakening their position in the market, and as far as a recognition of the union is concerned, the miners have been granted more concessions than seemed likely when the strike started. What recognition the union has received was conceded because the operators believed that the miners' organization would be a reliable body with which to conclude an agreement.

If the United Mine Workers Union is nothing, can do nothing, and stands powerless to meet socialistic violence and the machinations of foreigners, then there will be no value in recognition. The Mine Workers are proving that the early contention of the anthracite operators was true, and that the elements opposed to the union and opposed to law and order will not be bound by anything the union will agree to do.

It is time for the American element in the union to declare that their federation stands for order, and will approve what has seemed acceptable to its representatives.

Consumption

We always supposed the coal miner was healthy, and statistics favoring that belief only confirmed us in that view. But we see that the Bureau of Mines and Marine Hospital Service would not have it so and have combined to decimate the ranks of the miner with phthisis and hookworm. If the *coal* miner is to be thus menaced, we wish to protest. The U. S. Government every ten years gives him a clean bill of health, and Samuel G. Dixon, the Commissioner of Health of the State of Pennsylvania, showed in his report of 1908 that the miner was but little subject to consumption.

We quote, however, as a corrective of all false notions, the words which the director of the Bureau of Mines hopes to incorporate in his report to the President, and which we include today in our

pages: "Inquiries and investigations have already shown the prevalence of tuberculosis and hookworm as miners' diseases in a number of different localities in the United States."

The report of the Health Department of Pennsylvania, to which reference has been made, shows the following figures for tuberculosis, giving the percentage of deaths from that disease to those from all causes for all occupied males, and for miners and quarrymen.

	All Occupied Males	Miners and Quarrymen
Ages	Percentage	Percentage
25-34	30.9	5.3
35-44	24.3	11.8
45-54	14.4	11.6
55-64	7.6	12.8

In the first period of 10 years, consumption is particularly deadly among plumbers and gas fitters, 42.9 per cent. dying of tuberculosis. In the second decennial period the compositors, printers and pressmen show the largest death percentage from that disease; to wit, 49.2 per cent. In the next ten years the mill and factory (textile) workers have the highest figure, 17.5 per cent., and in the final period domestic servants have the greatest proportion of deaths from this malady, 13.0 per cent.

But it may be objected that the miner probably has a high death rate from all causes, especially from that of physical violence. This would account for the low percentage of deaths from consumption compared with those from all causes. But neither the statement nor its deduction is sustained so far as the somewhat restricted investigations of the Census Bureau in 1900 extend. The miner lives a fair span of life. To quote the exact words of the report on Vital Statistics, published in 1902 by that bureau: "The table" of miners' mortality "shows that the death rate of miners and quarrymen was much less than the average rate in this class." Totalling the government table, we find that while only 882.1 miners died in every 100,000 from all causes, 1298.5 occupied males in the same number succumbed to all manner of diseases and accidents. The mining and the quarrying class has, therefore, a distinctly lower death rate as far as the Census Bureau's figures extend.

Moreover, according to the same Vital Statistics, only 120.9 miners died in every 100,000 from tuberculosis, whereas of all occupied males 236.7 individuals died per 100,000 from that disease.

Such tuberculosis as is to be found among miners is largely confined to those men who work in metal mines. An accurate count of the coal diggers would doubtless show a comparative immunity among men working at the coal face.

The Mine Surveyor

State or governmental laws regulating the practice of mine surveying is one of the many serious problems confronting the coal industry today. Great Britain has finally adopted a definite policy in this respect by prescribing certain qualifications for mine surveyors, but there appears to have been such active opposition to the passage of the act that the ultimate result has been a relatively weak and ineffective compromise. Thus a certificate of competency may be obtained either from the Board of Mining Examinations, an approved educational institution, or will be issued on application to all holders of a first-class manager's certificate.

We seriously question the assumption that the college man, devoid of practical experience, is competent to assume responsible charge of extensive surveys. Nor do we believe that the qualifications of the surveyor should be determined entirely by mental examinations in mathematics, surveying, etc., since it is not at all improbable that a well posted draftsman, who has never been in a mine, could successfully stand such an examination.

Those familiar with colliery-engineering departments appreciate the value of a conscientious and thoroughly reliable transitman, and know that such men are found only among the experienced and well seasoned members of the profession. Any of the older engineers, looking back on the time they served as surveyor, can doubtless recall new shortcuts, checks and possible causes of inaccuracies which they continually were discovering.

Should state or government intervention along this line be attempted, it is to be hoped that the practical side will not be ignored entirely, as is too often the case. Errors in mine surveying frequently result, not only in heavy monetary losses, but in numerous fatalities, and if we are to have laws, let them be effective. "Running" a transit might be likened to running a locomotive, in that no experienced engineer would any more consider engaging an instrumentman on his mental attainments alone, than a railroad superintendent would think of hiring a locomotive engineer on like qualifications.

Present Day Waste

The conservationists have discussed the good of posterity so much that conservation has now a bitter smack of priggishness, like several other well meaning words—institutional work, welfare, altruism, uplift, benevolence and the rest of the drab sisterhood. But there is nothing benevolent about most forms of conservation, though the least hopeful and most remote forms have the loudest and most insistent "barkers."

Unfortunately, the figures for the days worked in mines of the United States in 1909 are not yet published, but in the five years preceding the year 1911, excluding the year aforesaid, the anthracite mines in Pennsylvania lost 507 days, excluding Sundays. The bituminous mines of the United States lost in the same period 498 days. This loss of productivity must have resulted in raising all the costs of producing coal.

Of course, miners are often absent from mines during the days when coal is being dumped, but, on the other hand, not a few work when the mines are officially declared idle, so that perhaps the productivity of a mine is normally to be gaged by the number of operating days.

The idleness increases the cost of coal, makes capital meanwhile unproductive, involves losses for upkeep and pumping, and results in the loss of tonnage.

In fact, it is possible that if by a combination of operators, this lost time could be reduced, there might be a reduction in the cost of coal, which would gratify consumers and make conditions better for owners and miners alike. The public must in the long run pay for the time during which the miner folds his arms or saunters casually downtown, or to the commissary.

The British Royal Commission on Mines has recommended the establishment of a lamp-testing station for the investigation of the velocity of explosive currents which different types of lamps can withstand, together with their illuminating power and sensitiveness in testing for mine gas. An excellent suggestion for our Bureau of Mines.

Discussion by Readers

Comment, Criticism and Debate upon Previous Articles, and Letters from Practical Men

Steel Mine Ties

Steel mine ties have been used to advantage in some districts. The accompanying Fig. 1 shows the latest, best and cheapest form of steel tie made. It is but ½ in. thick as compared to the 4 in. or more of a wooden tie, and this means a corresponding saving in the height to which every pound of coal must be lifted to be loaded into a mine car. The bolts used in the tie are the same as those in the rail-splice bars and no sledges, gages, spikes or spike pullers are needed for either laying or taking up ties. The only tool required is the wrench that is used for the rail-splice bolts.

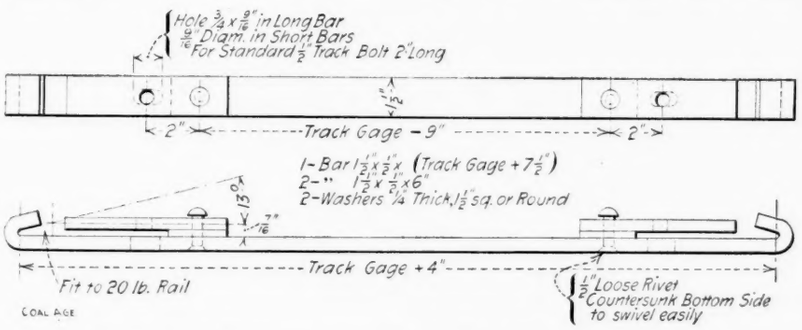

FIG. 1. MINE HAULAGE, STEEL TRACK TIE FOR MINE CARS

When these ties are used approaching the working face, short-length rails can be used with them, cut the same length as the depth of undercut made in the coal, in any particular mine. As the rail rests right on the floor but one tie, per rail length of 6 ft., or less is required. Since the gage is rigidly correct there is less trouble experienced from cars running off the track than when wooden ties are used; and there is less obstruction to travel for a mule, horse or man and less chance of injury to them through getting a foot caught or stumbling. The number of times that a wooden tie can be laid or taken up is limited, but there is no limit to the number of times this steel tie can be used. If bent it is easily straightened.

Each rail should have a pair of splice-bars loosely riveted on one end, so as to insure having splices where and when they are wanted, and to save labor in laying track. The splice-bars will have two of their holes already used, and putting down a length of track simply means putting in two bolts in each tie and two in the splices. The bolt holes in the rails should be ¾ in. for ½-in. bolts so that the track will be flexible and easily shifted sideways to enable it to be laid on considerable of a curve and yet not spring back but stay where it is put. The amount of flexibility depends on the length of the rails and the shorter they are the greater is the flexibility.

Ties of this general form have been known for years, but the particular improvements that this tie possesses and which make it superior to other types, are the use of loose-riveted clips that cannot get lost, and of washers to make thickness enough so that the same track bolts can be used as for the splice-bars. A further advantage is that the clip is easier to make because it is straight. The bolt hole in the tie is oblong to suit the diamond-shaped head end of a track bolt so that it cannot turn while the nut is being tightened or loosened, particularly the latter; because after a tie has been down a while the nut rusts the same as it does in the rail splice. The same track is good for outside use, for slate dumps and other temporary tracks. The first cost, per tie, is twice that of wood, but since not more than half as many are required, per foot of track, the total cost is no greater, while the steel ties are cheaper to lay and take up and are longer lived than wooden ties.

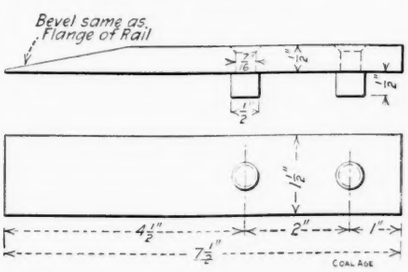

FIG. 2. STEEL MANDREL FOR SHAPING THE BENT ENDS OF STEEL TRACK TIES

In making these ties in an ordinary blacksmith shop, the holes are first punched or drilled by gage, then the bar to be bent is heated and a tool like that shown in the accompanying Fig. 2, is placed on it for a form, over which the bent end is quickly shaped by a few blows of the hammer. All parts are thus made to the same gage. The bottom head of the rivet is countersunk, as shown in Fig. 1, because it is easier to beat down such a head than it is to use a rivet set.

Ellsworth, Penn. F. D. BUFFUM.

Watering vs. Sprinkling

Referring to coal dust in mines, the Royal Commission, appointed some time since to investigate coal-dust explosions in mines, based their conclusions, if I am not mistaken, on the following points:

First. The best way to deal with coal dust is to see that all dusty entries and rooms are kept "watered," not "sprinkled." There is a difference in the meaning of these two words, watered and sprinkled. There is, I think, too much sprinkling and not enough watering done in our mines. In mines where the roads are dusty, the fireboss should be empowered to order that all roads be watered—watered, not sprinkled. In some mines, this watering is done with a watering car, which is, in my opinion, the best method to employ. In other mines, sprinkling is done by means of pipes laid on the roads and airways.

I will confess that the use of the watering car may often prove a disadvantage, especially in mines where there is a large output of coal. Nevertheless, we must consider the lives of the bread-winners and the wives and children dependent upon them. The watering car is often considered an unnecessary item of expense, as it requires the employment of one or two extra drivers and as many mules. If, however, this method would save the lives of even ten men, in one year, in the United States, I am sure that would counter-balance the extra expense, with interest added.

It has given me great pleasure to read the comments of James Ashworth, in COAL AGE, Apr. 20, p. 917. Mr. Ashworth gives his veiws on the watering of dusty mines, which I know will be greatly appreciated by many readers. I hope to see further discussion of this important question.

Terre Haute, Ind. FIREBOSS.

Reducing Ventilation When Firing

I have followed with much interest the discussion of this subject in COAL AGE, and must say that the contributions have furnished many valuable hints. Stress has been laid upon the dangers attending a strong draft, rapidly moving currents of air, and of fine dust carried in suspension in the mine air. There is, no doubt, some wisdom in reducing the ventilation when firing shots in a mine. Perhaps, however, the most interesting phase of the subject has not yet been touched. No doubt, some readers can recall having heard old superintendents say there were never any serious dust explosions in their particular sections of the country before mining laws made larger fans and greater volumes of fresh air compulsory. The popular demand was for fresh air for the miner, and that is the cry today in open light mines, where gas is never found.

But there is another side to this important question. The close analytical study of mine air is now beginning to change many long standing ideas concerning ventilation. There was a time when physicians tried to diagnose a patient's disease by looking at his tongue and timing his pulse. Today, a sample of the blood or waste product is taken and examined under the microscope, or chemically analyzed before the patient's true condition can be known.

In like manner, we are beginning to learn what kind of mine air is necessary to maintain health, also the kind of air in which it is possible to start a dust explosion. The chemist has suggested that the best method for the prevention of dust explosions in mines is to reduce the oxygen content of the air to 20 per cent., and for the most dangerous mines to 19 per cent., with a little carbon dioxide present. Such air, it is stated, is now breathed by men working at the coal face, in most mines, which is given as the reason why dust explosions seldom, if ever, traverse the working face.

We are told that with an atmosphere containing less than 17¼ per cent. oxygen (or 17½ per cent. with a little carbon dioxide, say ¾ of 1 per cent.), it is not only impossible to start a dust explosion, but also with this percentage of oxygen in the mine air, firedamp mixed in any proportion will not ignite when a flame is applied to the mixture. It is also further stated that with this depletion of oxygen in the air, a fire of wood or coal, in the roads, cannot be started.

Someone recently wrote Dr. Haldane, suggesting the feasibility of treating the intake air of a mine with furnace gases, and he replied, in relation to the depletion of the oxygen of the air by this means: "I can see no physiological difficulty in reducing the oxygen to 17½ per cent., provided you can eliminate the difficulties with carbon monoxide, also the lighting difficulty."

But in many mines, especially where carbon dioxide is given off by the coal, artificial treatment of the ingoing air will not be necessary to produce certain air conditions in the working places where shots are fired.

Perhaps this phase of the problem is worthy of extended discussion by readers. I will hazard the opinion that in the near future we shall regularly take samples of the mine air, and depend more upon the chemical analysis of such air when regulating ventilation than upon the anemometer. And all modern mines will be equipped with air-sampling and analyzing apparatus, as well as anemometers. Our ventilation laws will also be modified.

SAMUEL DEAN.

Delagua, Colo.

[A practically insurmountable difficulty in regard to any sampling and analyzing of the mine air is that which has always rendered useless such tests; namely, the conditions in the mine are constantly changing, and any such test can only have a local value, which will probably be of no avail by the time the results of the test are known.—EDITOR.]

The Pittsburg Rate Case

While I have no interests whatever in the Pittsburg rate case, I have been following this matter closely, and cannot see wherein any of the Pittsburg operators are benefited, as you seem to infer in your editorial on this subject in the Apr. 27 number. We are advised that the rate on coal to the lakes from the Fairmont and Kanawha fields has been reduced 10c., thus putting these rates on practically the same basis as heretofore. We do not have copies of the tariffs showing this reduction, but we were informed from reliable sources that such is the case.

In another place in the same issue, you state that the Pittsburg operators have increased their prices on coal to overcome the advance given the men. It has been true for the last several years that the Pittsburg operators increase their prices on coal, but they have never maintained these, and I venture the assertion that the prices on coal will be as low, if not lower, this year than last year.

There does not seem to be any question but that the increased development in the coal fields is more than the increased consumption, and, moreover, the railroad companies are in better position to move this commodity more quickly and they are furnishing a greater car supply than they have ever furnished before.

This letter may sound pessimistic, but it is not written with that idea. I believe that there should be an adjustment of the various freight rates, and your article with reference to the anthracite coal freighters bears this statement out. If the various companies and trade papers would follow this up it would surely help considerably.

S. A. CARSON,
General Manager.

So. Connellsville Coke Co.,
Uniontown, Penn.

[Our correspondent in stating that the rate from the Fairmont and Kanawha fields has been reduced 10c. has evidently misinterpreted our editorial or been misinformed. Quoting from the editorial: "As is well known, the Fairmont and Kanawha fields are the most important competitors in the Lake trade, and no revision in rates from these districts has been made." In the cases of the Baltimore & Ohio, the Chesapeake & Ohio and the Kanawha & Michigan lines, the decision was that the present rates from the Fairmont, Kanawha and New River fields of 96¾c., 97c. and $1.12 a ton respectively were fair and just, the proposed rates of $1, $1.06½ and $1.21¼ not being justified. While no increase in these rates was made, there was not, on the other hand, any reduction, as our correspondent seems to infer, although the fact that no increase was granted acts indirectly as a decrease.

With reference to Mr. Carson's assertion to the effect that the price on coal would be as low, if not lower this year than last year, and questioning our statement that the Pittsburg operators have increased their prices to overcome the advance given the miners, we believe in the former instance that such may quite probably be the case. We presume that he is referring to the statement in the first column on page 960, which says: "There is no demand but producers are naming prices on a basis of 7½c. higher than last year's regular or official basis." Further along in the same paragraph it says: "These prices constitute the quotable market at the moment, but whether they will hold is another matter. Last year's prices based on $1.15 were shaded during the major portion of the season." It will be noted here that we give these figures as the quotable market at the moment and question ourselves whether they will hold. And we further note that last year the quoted prices were shaded during most of the season. Our correspondent is thoroughly justified in his belief that the present circular prices will not be maintained throughout the season, as has been amply proved in previous years, but since these are the prices being quoted at the present time, they are obviously of value to the trade.—EDITOR.]

Inquiries of General Interest

All Questions Must be Accompanied by Name and Address—Not for Publication

Will a Carbide Lamp Burn in Carbon Dioxide?

Kindly answer the following questions in COAL AGE: Will a carbide lamp burn in carbon dioxide? What is the chemical formula for calcium carbide and the equation that expresses its reaction with water and shows the resulting gas that produces the light? Is it true that the chief mine inspector of Ohio will not permit carbide lights to be used in the mines in that state?

C. K. ROCKHOLD,
Night Foreman.

Sunnyside, Utah.

The question is often asked, "Will a carbide lamp burn in blackdamp?" and the answer is, "Yes." There is, however, a great difference between blackdamp and carbon dioxide. The former is a variable mixture of one or more extinctive gases and air. It therefore contains some available oxygen, which supports the flame of the lamp. On the contrary, carbon dioxide (CO_2) contains no free or available oxygen; and, for this reason, no flame dependent on oxygen for its combustion can burn in this gas.

It is often asserted and the idea has become quite prevalent that a carbide lamp will burn in an atmosphere of carbon dioxide; that it is not dependent for its combustion on oxygen or air; and this argument has been used, at times, to press the claims of this lamp for mining use. Both statements are wrong. The idea probably grew out of the fact that it is common for mining men to call blackdamp, carbon dioxide. But, as just explained, the two are widely different; and, while the carbide lamp will burn in blackdamp that will extinguish most other lights, it will not burn in pure carbon dioxide, because that gas contains no free oxygen.

The acetylene flame of the carbide lamp, like the hydrogen flame, is extremely tenacious. While a candle and other wick-fed flames are extinguished by about 14 per cent. of carbon dioxide added to the air (artificial atmosphere); or by from 3 to 4 per cent. of carbon dioxide, in a residual atmosphere, where the flame is inclosed in a confined space and allowed to burn till it goes out; the hydrogen flame is only extinguished, in an artificial atmosphere, when the latter contains practically 58 per cent. of carbon dioxide; and the acetylene flame is almost equally tenacious.

It is important, however, in this connection to state that, owing to this property of the acetylene flame, the carbide lamp fails to indicate the presence of blackdamp in the mine air, with sufficient promptness to avoid danger, since 18 per cent. of CO_2, in an artificial atmosphere*, may produce fatal results if breathed but a short time. The lamp is not a safe lamp to use in mine workings generating much blackdamp, any more than the electric lamp is safe in mines generating marsh gas.

The chemical formula for calcium carbide is CaC_2. The chemical equation expressing the reaction of this carbide with water is:

Calcium carbide		Water		Calcium hydrate		Acetylene
CaC_2	+	$2\ H_2O$	=	$Ca\ (OH)_2$	+	C_2H_2

The equation that expresses the combustion of the acetylene gas in oxygen is:

Acetylene		Oxygen		Carbon dioxide		Water vapor
$2\ C_2H_2$	+	$5\ O_2$	=	$4\ CO_2$	+	$2\ H_2O$

The Ohio mining law, as revised June 11, 1910, and again the following year, 1911, prohibits the use, in any coal mine in that state, of "any fish oil or other luminant whatever, other than those specifically provided for" in the section (974).

The chief mine inspector, June 5, 1911, issued a circular drawing attention to the new law and notifying all mine foremen in charge of mines, in the state, that they would be held responsible for the use of any illuminant, in their respective mines, other than oils of the standard required by law.

Safety Lamps, Types and Construction, Relative Safety

Please explain the essential differences and the construction of the Davy, Clanny and Wolf lamps. Which of these is the safest lamp to use in a gassy mine; and in what does this safety consist?

STUDENT.

Altoona, Penn.

The Davy lamp has no glass but a full gauze chimney surrounding the flame, which permits a free circulation of air passing in and out of the lamp. While this free circulation of air renders the Davy more sensitive to gas than is the case with other lamps, the same fact makes it an unsafe lamp for general work or to place in the hands of the ordinary miner. The lamp, because of its sensitiveness, "flames" readily in gas. When this happens it requires much presence of mind and self-control to avoid making a sudden movement that may force the flame through the gauze and fire the gas outside of the lamp.

The Clanny lamp differs from the Davy in having a glass cylinder surrounding the flame and which forms the lower half of the chimney; the upper half being gauze the same as the Davy. This improves the light, which is not obstructed by the gauze mesh. The air enters the Clanny lamp through the lower portion of the gauze, above the glass, and must therefore descend to the flame. There are, thus, two conflicting air currents in the lamp, which gives all Clanny lamps a tendency to smoke. This lamp is not as sensitive to gas as the Davy lamp, but affords greater protection of the flame against strong air currents.

The Wolf lamp is an improved type of Clanny lamp, having a glass cylinder surmounted by a gauze chimney. It differs from the Clanny in the fact that the air enters this lamp through a gauze ring below the glass, which gives a better circulation in the lamp and improves the light. The Wolf lamp is particularly designed to burn naphtha, a highly volatile and explosive oil. The oil vessel of the lamp contains a specially prepared cotton that is used to absorb the oil and reduce the danger of explosion in the lamp. Owing to the ease with which the naphtha flame is extinguished, the Wolf lamp is supplied with a special igniter for relighting the lamp when accidentally extinguished.

No so called safety lamp is *safe* unless properly handled, and kept in good condition. Its safety depends on the isolation of the flame from the outside air, by means of a chimney of wire gauze, or glass and gauze combined. The cool wire forming the mesh of the gauze allows the free passage of the air and gas, but kills the flame by absorbing its heat whenever the flame approaches the wire. If the gauze becomes heated, or is imperfect or dirty, or the lamp is exposed to a strong air pressure, the flame may pass through the mesh of the gauze. In other words, under these conditions, the lamp may fail.

*The term artificial atmosphere as here used, means an atmosphere containing a normal percentage of oxygen, the CO_2 being added; in distinction to a residual atmosphere, which is the atmosphere resulting from the burning of a lamp, or some other form of combustion, by which the oxygen content has been depleted. Practically, all mine atmospheres containing blackdamp or other gases are artificial atmospheres, except the afterdamp of an explosion, which may be residual.

Examination Questions

Selected from State Examinations, or Suggested by Correspondents

Sundry Examination Questions

(Answered by request)

Ventilation, to Find Area for Given Length of Airway, Quantity of Air and Water Gage

Ques.—What must be the sectional area of an airway 5000 ft. long, in order that it will pass 10,000 cu.ft. of air per min., under a water gage of 1.7 inches?

Ill. Exam.

Ans.—In order to solve this question it is necessary to know the shape of the cross-section of the airway, so as to be able to reduce the two unknown quantities (perimeter and area) to a single term (diameter or side).

The formula for unit pressure, in terms of the airway and quantity of air, is

$$p = \frac{klo q^2}{a^3}$$

In this case, the values are all given except the perimeter (o) and area (a); therefore,

$$\frac{a^3}{o} = \frac{0.00000002 \times 5000 \times 10{,}000^2}{5.2 \times 1.7} = 1131.22$$

For circular airway,

$$\frac{a^3}{o} = \frac{(\pi r^2)^3}{2\pi r} = \frac{\pi^2 r^5}{2} = 4.9348\, r^5$$

and

$$r = \sqrt[5]{\frac{1131.22}{4.9348}} = \sqrt[5]{229.23} = 2.96, \text{ say } 3 \text{ ft.}$$

The diameter of this airway, to meet the requirements in the question, must be practically 6 ft., and its area is then

$$0.7854 \times 6^2 = 28.27 \text{ sq.ft.}$$

For square airway (side = d, area = d^2),

$$\frac{a^3}{o} = \frac{(d^2)^3}{4d} = \frac{d^5}{4}$$

Then

$$d = \sqrt[5]{4 \times 1131.22} = 5.384 \text{ ft.}$$
$$Area = 5.384^2 = 29 \text{ sq.ft.}$$

For a rectangular airway (height = a, width = b), perimeter = $2(a + b)$; area = ab.

Assume $b = na$; then,

$$Perimeter = 2(a + na) = 2a(n + 1)$$
$$Area = a \times na = na^2$$

Then,

$$\frac{a^3}{o} = \frac{(na^2)^3}{2a(n+1)} = \frac{n^3}{2(n+1)} a^5$$

Suppose the width of the airway is double its height; then, $n = 2$; and

$$\frac{a^3}{o} = \frac{2^3}{2(2+1)} a^5 = \frac{4}{3} a^5$$

Finally,

$$a = \sqrt[5]{0.75 \times 1131.22} = 3.85 \text{ ft.}$$
$$b = 2 \times 3.85 = 7.6 \text{ ft.}$$

The airway, in this case, is 3.85 × 7.6 ft.; its area is 3.85 × 7.6 = 29.26 sq.ft.

It is thus seen that a circular airway requires the smallest area; the square airway the next; and the rectangular the largest, to pass a given quantity of air under a given pressure.

Ventilation—Comparing Two Airways

Ques.—Of two airways, one 7 ft. wide and 6 ft. high, the other 14 ft. wide and 3 ft. high, which will pass the greater quantity of air, other conditions being equal; and why?

Tenn. Exam.

Ans.—The areas of these airways are equal; 7 × 6 = 42 sq.ft., and 14 × 3 = 42 sq.ft. Assuming the airways have the same length, the one having the smaller perimeter will have likewise the smaller rubbing surface, and will pass the greater quantity of air, for the same pressure or power on the air.

The perimeter of the airways, in this case, are, respectively,

6x7 *-ft. airway*, 2 (6 + 7) = 26 *sq.ft.*
3x14-*ft. airway*, 2 (3 + 14) = 34 *sq.ft.*

The 6x7-ft. airway will therefore pass more air, under the same pressure or power, than the 3x14-ft. airway. The ratios of the quantities are as follows:

Equal pressure,

$$\frac{q_1}{q_2} = \sqrt{\frac{34}{26}} = \sqrt[2]{1.3077} = 1.14+$$

Equal power,

$$\frac{q_1}{q_2} = \sqrt[3]{\frac{34}{26}} = \sqrt[3]{1.3077} = 1.09+$$

That is to say, for each 10,000 cu.ft. of air in the 3x14-ft. airway, under equal pressure, the 6x7-ft. airway will pass 11,400 cu.ft.; or, under equal power, 10,900 cu.ft. of air.

Percentage of Gas, Height of Cap

Ques.—What is the formula for calculating the percentage of gas from the height of flame cap observed? What percentage of gas is indicated by a ¾-in. cap?

Ans.—When using the unbonneted Davy lamp, the percentage of gas is given by the formula

$$J = \sqrt[3]{36h}$$

Or, for a ¾-in. cap

$$J = \sqrt[3]{36 \times 0.75} = \sqrt[3]{27} = 3\%$$

When using a bonneted Davy

$$J = \sqrt[3]{70h}$$

Or, for a ¾-in. cap

$$J = \sqrt[3]{70 \times 0.75} = \sqrt[3]{52.5} = 3\tfrac{3}{4}\%$$

Horsepower in Ventilation

Ques.—(a) If 10 hp. is producing a circulation of 60,000 cu.ft. of air, in a mine, what is the water gage? (b) What quantity of air and what water gage will be produced in this mine, when the horsepower is increased to 25 hp.?

Ans.—(a) The water gage is

$$w.g. = \frac{10 \times 33{,}000}{5.2 \times 60{,}000} = 1.057 \text{ in.}$$

(b) In any given mine or airway the quantity of air circulated is proportional to the cube root of the power producing the circulation. Or, in other words, the quantity ratio is equal to the cube root of the power ratio. Then since the water gage (or pressure) varies as the square of the quantity, the water-gage ratio is equal to the cube root of the square of the power ratio. Hence, for the quantity,

$$\frac{q}{60{,}000} = \sqrt[3]{\frac{25}{10}} = \sqrt[3]{2.5}$$

$$q = 60{,}000 \sqrt[3]{2.5} = 60{,}000 \times 1.357$$
$$= \text{say } 81{,}400 \text{ cu.ft. per min.}$$

For the increased water gage due to 25 hp.,

$$\frac{w.g.}{1.057} = \sqrt[3]{2.5^2} = \sqrt[3]{6.25}$$

$$w.g. = 1.057 \sqrt[3]{6.25} = 1.057 \times 1.842$$
$$= 1.947 \text{ in.}$$

Coefficient of Friction

Ques.—What is meant by the term *coefficient of friction*, as used in mine ventilation? Give an example showing how such coefficient is used.

Ans.—For a full explanation of the coefficient of friction and its use in mine ventilation, see Coal Age, Feb. 24, p. 653.

Water Gage Required to Double Circulation

Ques.—If 20,000 cu.ft. of air per min. is circulated in a certain mine, by a water gage of 3.5 in., what water gage will be required to increase this quantity to 40,000 cu.ft. per min.; in other words, to double the circulation?

Ans.—For the same mine or airway, the pressure or water gage varies as the square of the quantity of air circulated. In other words, the water-gage ratio is then equal to the square of the quantity ratio. In this case, calling the required water gage x,

$$\frac{x}{3.5} = \left(\frac{40{,}000}{20{,}000}\right)^2 = 2^2 = 4$$
$$x = 3.5 \times 4 = 14 \text{ in.}$$

Sociological Department

For the Betterment of Living Conditions in Mining Communities

Human Element in Coal Mining

By Sim Reynolds* and W. H. Reynolds

During the last 25 years, we have had experience in mines of all kinds from the crudest, dug in the side of a low hill, to mines approached by deep shafts and as nearly perfect as human thought and effort can make them. And our experiences have driven home, like reiterated sledge-hammer blows, the conviction that perfection is far from being attained when the finest installation, mechanically speaking, has been completed.

No mine, no matter how costly may have been its development, no matter with what almost excessive care it may have been planned and its construction executed, is safer than the most careless employee permits it to be. The mine is always at the mercy of an illiterate and reckless foreigner, or of an over-ambitious, output-crazed mine foreman. The whole chain of caution, mechanical perfection and provision snaps at its weakest link, the human element.

The Near American Steps Aside for the Wholly Alien

Large capital is adopting improved machines and systems, the former more readily than the latter, but we face a difficulty which new mechanism and improved mining practice cannot over-balance. The apex of our former labor pyramid has become its base. While the immigrants, who poured into our coal-fields, in the seventies and eighties numbered nine of British, German or Scandinavian nationality to one from other countries, now there is but one man from those countries to eight or nine Italians, Greeks and Slavs.

To quote the mine reports of the State of Pennsylvania in reference to underground labor:

> Information received from 98 per cent. of the operators shows that 40 per cent. of the employees are of the English speaking races, while 60 per cent. are non-English speaking. Of those killed, 73.62 per cent. were of the latter class, and only 26.38 per cent. were Americans, English, Scotch, Irish and German. If the accidents among these people had been proportionate to the total number of each class employed, 102 of the latter class of men would have been killed instead of 67.

*Pittsburg-Buffalo Co., Marianna, Penn.

Discipline Needed More Than Legislation

It is plain, therefore, to the most casual reader that the men in charge of mines where such conditions exist are working under a natural disadvantage, regardless of all the aid which may be given to the managements by generous mine owners. It will be seen at once that mining officials have a more difficult proposition than confronts any other men in charge of employees working in extra hazardous occupations.

James E. Roderick may be quoted again:

> Legislation of the proper kind would, no doubt, bring about a reduction of fatalities, but the most prolific cause, which is carelessness on the part of mine officials and employees, can be removed only by greater discipline, discipline which will enforce obedience to those laws and rules which have been framed to give a greater degree of safety, discipline that will mete out severe punishment to the man in charge, and to the employee alike, who, by their carelessness or recklessness, place the lives of the men in the mines in constant jeopardy.

Polyglot Foremen

The other day a suggestion appeared which is more humorous and decidedly less practicable than that quoted. It was made at a meeting of the American Society of Mining Engineers. In brief it was to the effect that the men in charge of mines should learn the languages of the different classes of workmen so that they could instruct every employee in his native tongue, regarding the rules of the mine and the observance thereof. The idea is good, very good indeed, doubtless too good to be generally carried into action in the great gas-coal fields. Evidently the speaker was never much nearer the average gas-coal mine than an office on Broadway or some such street in a large city.

If he had been, he would have understood that the foreman of an uptodate mine in a gas-coal region hardly has the time to express himself properly in English, certainly not in all the tongues of southern Europe. Unless he had learned the several languages when a miner, or while yet a boy in common school, he could scarcely hope to find such an easy berth that he would have sufficient time left in each 24 hours to become an efficient linguist, unless he could procure his education in this respect by a cash purchase.

If this be possible, we readily acquiesce in the proposition advanced, and think that in view of the chaotic condition of mine labor it would be a profitable investment for every mine operator to purchase an assorted dozen of linguistic proficiencies ready for use in each large mine, as many a foreman or superintendent in the gas-coal country could use them all, with the possible exception of Hebrew and Chinese.

The Care of Mine Mules

By Matthew J. Davies

The mule has never been supposed to possess any surplus brains, while, on the other hand, I believe it has never been given full credit for the intelligence it sometimes displays. Mules vary in their temperaments and dispositions, much as men do. Some are docile and tractable, others lively and spirited, and some are very refractory and even vicious. Occasionally, we have known them to lie in wait craftily for days and even weeks, seeking an opportunity to kick drivers who have mistreated them, and they sometimes accomplish their purpose with fatal results. But, on the whole, in my experience with mules, I have found that they readily respond to kindness, and are amenable to good treatment.

Improvement in Stables

As to care of mules, the first essential is a clean, comfortable and sanitary stable, with plenty of headroom, sufficient ventilation and good drainage, and an abundance of pure water, rather than the foul, ill-smelling and disease-breeding quarters in which mules are stabled in some collieries. The fact that the animal survives any length of time in some of the stables we have seen, despite the hard and severe toil, it is called upon to perform, is a remarkable tribute to its hardiness and endurance.

It is gratifying to note that during the last year, prompted by legislative enactment, a notable change has taken place along these lines. The mule is coming to his own, even though the reform is actuated more from fear of fire and its consequent results, than from any regard for the poor beast's comfort. But the Delaware, Lackawanna & Western R.R. Co. began improving its inside stables many years ago, before there was a hint of legislative compulsion.

There are four or five classes of workmen in our collieries, who come into personal contact with the mule. Upon

their intelligence, good judgment and exercise of common sense, its usefulness and efficiency, largely depend. These are the barn boss, the driver, the driver boss and the shoer, and we might also add, the car runner. The barn boss must feed the mules judiciously, and if an inferior grade of hay and grain is furnished, he should promptly report that fact.

The Barn Boss

The barn boss should be responsible for the proper preparation of a mule for work, see that it is properly cleaned, for which purpose curry combs and brushes must be provided. Sufficient time must be spent in cleaning and harnessing each mule. The barn boss must give special attention to the fit of the collars and thus prevent shoulder galls, which are caused in most instances by the collar being either too large or too small. Drivers should not, under any circumstances, be allowed to change collars. It is the duty of the barn boss to clean the collars every night, and for this purpose he should provide himself with scrapers. Next in importance to the collar is a well fitting hame.

On all harness, the trace chains must be equal in length, about 8 ft. long, composed of 4-in. links of ⅜-in. iron. To secure this when a trace is sent for repair, its mate must be sent with it. Leather chain pipes and special pads for the protection of the mule should be used when needed; also a strong leather cap piece on the bridle to protect its head.

The barn boss should be on hand every night to inspect the mules when they return from work and to see that no injuries have been received during the day. All injuries must be given proper attention at once. If the barn boss suspects the injury to be the result of carelessness or abuse, he should promptly report the matter to the mine foreman for investigation.

The barn boss must keep the barn dry and in good order. The stables should be cleaned every day and lime sprinkled on the floor every other day. Water troughs in front of the mules should be cleaned at least two or three times each week, and the food boxes cleaned regularly each day. Mules should be given fine salt twice a week, not mixed with feed, but placed in a little box provided for it on the manger. Stables should be lighted by electricity.

Mules should not be allowed to work for two consecutive shifts, except in cases of extreme necessity. Their hoofs should be kept in good condition, and each mule should be shod on all four feet once a month. When a mule is taken sick, the barn boss should immediately administer the proper medicine, of which a sufficient supply must be kept on hand. Cases of severe injury, accompanied with loss of blood, must receive prompt attention until the bleeding has ceased and the animal made comfortable. In addition to medicines, the barn boss must keep on hand other articles and supplies appropriate in emergency cases, such as oakum, cotton, bandages, antiseptics, etc.

Duties of Driver

Another important person in connection with the care and welfare of the mule is the driver. We cannot fail to realize this, when we consider that both are closely associated, as a rule, for about 10 or 11 hours each working day. Drivers should not drive their mules faster than a walk, either when working them or in going to and from the barn. As a rule, drivers are in a bigger hurry to get to the barn than to leave it, and are prone to compel the mules to trot and hurry, which severely tries them after a hard day's work.

Care of the Mule

When leaving mules, drivers should first tie them in a safe place, out of danger from moving cars, or other sources of injury. On descending grades, mules should always be unhitched from the trip and walked down behind it. They should always be led, never driven, through narrow places, for the instant they feel pressure in a narrow passage, they fear danger and make a sudden spring forward. I have known mules to receive serious injury in this manner.

When shifting cars into chambers, mules must not be driven beyond the last point at which they can turn easily, nor driven over loose coal lying on or beside the track. The practice of breasting cars into the chambers should be strictly prohibited. The summits of all grades, toward which mules are used to haul cars, should be furnished with safe and reliable headlocks, to prevent the cars from running against the mule. In fact, headlocks should be placed wherever necessary to prevent accidents. When ascending grades, drivers must have drags in place on the rear car of each trip.

Mules should not be allowed to pass under charged electric wires, and in returning to the barn, they should always be accompanied by the driver. The driver must also watch the feet of his mules, and, when shoes are lost, have them replaced at once. Mules must not be worked unshod.

Driver Bosses

The driver boss should confer and work in harmony with the barn boss in all matters relating to the care, protection and general welfare of the mules; and in order to do this, he should be in the barn every morning in time to see that every mule is properly cleaned and prepared for the day's work. He should also see that all haulage roads in his section are kept smooth and level with ashes or dirt and free from coal, rock and timber, and properly drained where necessary. Where headblocks or drags are required for the safety and protection of the mules, he should see that they are provided.

The driver boss and the barn boss should confer with each other and be careful when making up a team to select mules which will mate well. The quick and the slow, the dull and the nervous, the weak and the strong, should not be placed in the same team. This is an important matter, and cannot be given too much thought and consideration.

Where blocks and chains are used, the chains should be four feet long, and it should be borne in mind that, "no chain is stronger than its weakest link." The driver boss should never allow a miner to repair a broken chain with wire. In all cases where a block and chain is used, a drag should be attached to the rear of the car. Wherever two rails form an acute angle, into which a mule is liable to thrust its hoof, it should be properly wedged and blocked. The driver boss should also see that all trace chains and spreader sticks are of proper length. The dimension of the latter is dependent on the track gage, the standard lengths being 31 and 33 inches.

No side hitching should be allowed unless there is ample room to do so without any danger of injury to the mule. Mules should not be changed from one working place to another without sufficient reason. A change may be necessary sometimes, in order to lighten their work.

Great care should be exercised in handling a green mule. It should be first placed in charge of an experienced driver, given light work, and gradually broken in, until trained and fitted for the regular and more difficult work. Overloading or overworking a mule cannot be too strongly condemned. After the mules have left the barn, the driver boss should spend as much time as possible near them and their drivers, and insist that the former receive good treatment and a square deal.

My sympathy is with the poor animal, which is compelled to perform hard, grinding toil, in more or less dust and smoke, for nine or ten consecutive hours without even a drink of water or a grain of food. At little expense, ½-in. or ¾-in. pipe line could be laid to central locations, through which water could be conveyed to a trough, and at noon the mules could be watered with little loss of time.

Every driver could be furnished with a canvas nose bag, containing a small quantity of grain or corn for the mule to eat while the driver is having his own dinner. The renewed vigor with which the mule would attack its work and the resulting gain in efficiency would, in my opinion, amply repay the loss of time, if any, and the expense incurred.

Coal and Coke News

From Our Own Representatives in Various Important Mining Centers

Washington, D. C.

Dr. J. A. Holmes, of the Bureau of Mines, has made a statement before the House Committee on Appropriations concerning the investigations of the bureau. This has just been made public. He asks for arrangements that will concentrate the work more largely in Washington and will render it more efficient.

Dr. Holmes states that the work now being done outside the bureau offices and laboratories is as follows: At the University of Ohio, a study of clays is being made in connection with general quarry or mineral products; at Princeton, chemical work is conducted in relation to mine accidents. This should go partly to Pittsburg and partly to Washington. At New Hampshire College, work relative to mineral wastes is being carried on.

"We get the supervision of the university men free," he adds, "but we have a man at the University of Ohio, for example, in our own employ, whom we want to bring here. There is great advantage in having all these men and their work brought to Washington; but unless the bureau can get the increase in space asked for, it will be compelled to send other men out to such institutions as will give us space rent free. We are studying clays and other products from the quarries examined, in connection with the quarry methods, and the action of clays and various mineral substances, on coal and ores, and other substances of that kind."

It is expected that the changes thus requested will be made. With further reference to the need of new quarters, Dr. Holmes says that when the present building was arranged for, only about 33 persons were connected with the work of the Bureau of Mines in Washington. At the present time, the building is occupied by between 90 and 100 people. "So the situation today is that the Bureau of Mines is exceedingly crowded in its work, and cannot continue its work efficiently within the limited space of this building."

Market for Alaskan Coal

The Senate has had printed as senate document No. 573, a partial report of the proceedings of the fourteenth annual convention of the American Mining Congress, under the title "Alaskan Problems." It is interesting to note that the problem which figures most prominently in this document is the mining and transportation of coal.

Special attention is given to papers on this subject and notably to a discussion of "Coal Transportation in Alaska." In this paper, great stress is laid upon the question of a market for the coal, stating, in part, that:

> It is doubtful if there is a market for much Alaska coal outside of Alaska. Eastern people and those of the Middle West do not appreciate that there is plenty of coal on the Pacific coast, much more accessibly located than that of Alaska, besides fuel oil in abundance, and the most marvelous hydro-electric power in the world. Even in Alaska the Treadwell mines and the Copper River R.R. are being operated by California fuel oil, and it is evident that Alaska steaming coal has little demand upon the Pacific coast of the United States in the face of such competition. A market will ultimately be made for some Alaska anthracite, and the Alaska coking coal will be of great importance, especially in the treatment of the low-grade copper ore along the Alaska coast. The United States Navy, which is now importing coal from West Virginia, might save the price of a battleship in a few years by using Alaska coal, but the Alaska fields really have little bearing upon the great question as to the future policy for the disposition of coal lands upon the public domain of the United States. Some new system must be adopted in Alaska, however, and consequently this subject has been given mature consideration. Two methods have been suggested: One a leasing system, and the other, government operation of the coal mines.

Alabama

Birmingham—An explosion took place in the third right heading, bottom slope, of the Roden Coal Co.'s mine at Marvel, Bibb County, Ala., at approximately 10 a.m., Apr. 30. This resulted in the injury of eight men. None of them was seriously burned, although one was nearly dead when rescued, from suffocation.

At every mine in the Cahaba coal field there is more or less gas. In the Marvel mine, gas has only shown up on four out of 28 headings, and in very small quantities. The explosion was caused by a driver carrying an open lamp by a room in which men, employed by the company, were fanning out the gas to make the room safe for working the next day. That the amount of gas was small is evidenced by the fact that there was very little concussion, merely a sheet of flame, which lasted only a few seconds. The force of the explosion was not felt on the surface and in but few of the other working places. The news was telephoned to the top, and immediately a rescue party was organized. All the air was thrown from the top slope to the bottom slope, giving it double the usual quantity.

Helena—It is generally rumored here that the Wadsworth Red Ash Coal Co. is negotiating for a lease of the old No. 2 mine, from the Tennessee Coal, Iron & R.R. Co. It is also stated that the Red Ash company will purchase the Otto Marks property which adjoins the No. 2 mine. The properties lie about two miles from Helena and if the negotiations are successful it is expected that operations will begin at once.

Colorado

Denver—Coal operators in the southern Colorado district have consented to recognize the check weighing system and hereafter this system will be in use at the Green Cañon, Suffield, Royal, Shaft and Empire mines. Union weighmen have been reinstated in all mines in the Aguilar district. The men also have been granted a "checkoff" of the checkman's wages. This recognition has been the direct result, it is claimed by union labor leaders, of the efforts of the United Mine Workers' organization in this state.

Pueblo—By a compromise effected between the federal land office and the Denver and Rio Grande R.R., 8465 acres of coal lands in Colorado, having a market value of $1,755,750, held by the Atlas Utah Fuel and the Calumet Fuel companies, subsidiaries of the railway system, have been conveyed back to the United States government and will be thrown open to purchase. The lands are situated in Gunnison and La Plata counties and comprise some of the best bituminous coal deposits in the west. The largest tract is in La Plata County and embraces 5385 acres of unpatented and 640 acres of patented lands. Close to the city of Pueblo is a tract of 400 acres and the remaining 840 acres are in Gunnison County. The last named acreage is the most valuable, there being 8 seams, which have a total thickness of 70 feet.

Illinois

Panama—An explosion in the mine of the Shoal Creek Coal Co., recently killed two men who had been left in charge of the mine, which was idle at the time.

Other men who were in the mine escaped without injury.

Canton—The tipple of Star mine, No. 2, burned to the ground recently before help could arrive to extinguish the flames. The fire is supposed to have been started by lighting, but the blaze did not break out until about half an hour after the storm. The tipple was built 5 years ago and will probably be rebuilt inmmediately as there is still much good coal on the property.

Republic—The Interurban Electric Co., which operates an electric line between Carterville and Herrin, Ill., has been reorganized by officials of the National Light & Power Co. of St. Louis, who have arranged to extend the service to the coal-mining district of southern Illinois. St. Louis capital will finance the proposed extensions. The present plan is to extend the line from Herrin through the towns of Craneville and Reeves, and to supply power for the operation of the coal mines, of which there are about 60 in the territory reached. The present headquarters of the Interurban company are at Carterville, Ill.

Indiana

Terre Haute—Indiana coal operators and members of district No. 11 United Mine Workers, after three sessions of the joint wage conference, which opened at Terre Haute, Apr. 30, were no nearer an agreement than they were at the beginning of the conference. The question of resuming work at the mines pending a settlement of all differences and demands was the principal contention, and a motion advocating resumption made by Mr. Penna was promptly voted down by the miners. It now looks as though there will be weeks of parleying before an agreement will be reached and work resumed. This is unfortunate and disappointing because the demand for coal is becoming persistent. The operators charge that the miners are going beyond their sphere in trying to set the price of powder, the selling price of coal and in making other demands. Some of the demands made by the men are:

A weekly pay. A reduction in the price of blacksmithing to ½c. on the dollar on the gross earning for pick miners and nothing for machine miners. A charge of $1.25 a keg for powder. That when a part of a mine is shut down the men so affected shall be entitled to their share of work in the parts of the mine that continue at work. That a reasonable price for house coal be charged from those working in or around the mines. Reasonable price not to exceed 5 per cent. of actual cost. That where a company wrongfully stops a man's turn such company shall remunerate him for time so lost.

A deadlock likewise has been reached by the scale committee of District No. 8 meeting at Brazil, and there is no indication of an early settlement. The matter has been referred to a sub-committee composed of four miners and four operators. The operators refuse to even consider the clause which provides that they shall not discriminate in the employment of men on account of creed, color or their activity in matters affecting the miners' union. The operators declare that they have a perfect right to consider the kind of men that they employ, and under no circumstances will they sign the scale containing a clause which provides for the employment of men in the order in which their cards are deposited. The miners insist that this clause must stand.

Kansas

Pittsburg—Two new coal companies have recently been organized to conduct stripping operations in this vicinity. These are the Nesch Coal Co. and the Pittsburg-Scammon Coal Co. The latter concern is allied with the Pittsburg Brick Co. and will not place its product on the market to any great extent.

Kentucky

Louisville—Failure to agree upon an interpretation of the Cleveland wage-scale compromise which was to be the basis of settlement between the miners and operators of western Kentucky, led to a proposition on the part of the Western Kentucky Coal Operators' Association to submit the matter to arbitration. The wages offered by the operators will be submitted to a referendum vote of the miners. The mines affected have been idle for more than a month pending a settlement of the questions at issue.

The Interstate Commerce Commission has suspended, until Nov. 1, tariffs of the Louisville & Nashville R.R., advancing rates on coal and coke from points on its line to points on the Big Four. The rates were to have become effective May 1.

Providence—The coal mine and other property of the Fairmount Coal & Mining Co., of Providence, will be sold at public auction May 22 Glenn R. Fudaley, of Madisonville, Ky., is trustee in bankruptcy for the company.

Whitesburg—The Schoberth Syndicate of Philadelphia, has purchased 5000 acres of coal and timber land along Carr's Fork and Beaver Creek in Knott County.

Henderson—Thinking he was hoisting a load of coal the engineer of a mine at Clay, Ky., recently ran the cage up hastily and dumped it, dropping a miner 100 ft. to the bottom of the shaft and killing him instantly. Two others were hurt.

Ashland—A new company has been incorporated in Kentucky by officers of the Norfolk & Western Ry. Co., to build a line from Williamson, W. Va., to Pikeville, Ky. It will be 20 miles long, with branches, and is to be completed by June 1, 1913.

Missouri

Kansas City—Conferees representing coal miners and operators of the Southwest have renewed their agreement that there shall be no suspension of operations while negotiations for a new contract are pending. This provision of the old contract expired May 1. It is said that the sub-committee which is considering the arbitration clause of the new agreement is making good progress.

Montana

Missoula—After a thorough examination, the Butler Creek Coal Co. is about to commence active development work on its properties located between La Valle Creek and Butler Creek, about seven miles from Missoula. A shaft is now being sunk to a coal seam having a thickness of between 5 and 6 ft. The coal is a lignite of the miocene formation and carries only about 4 per cent. of ash. It is particularly adaptable to briquetting, and with this treatment its fuel value will be increased materially. It is proposed to install a briquetting plant in the near future.

Ohio

East Liverpool—Six thousand acres of valuable coal land, north of East Liverpool and Wellsville have been taken over by the West Point Coal & Coke Co. Confirmation of this deal, the most extensive in some years, was secured recently from J. L. Francis, president of the company. The deal involves an immediate outlay of from $100,000 to $150,000. It is conjectured that the purchase means an early beginning on the construction of the proposed Ohio River & Northern R.R. from Midland, Penn., past East Liverpool and Wellsville and thence to West Point. Mr. Francis stated that the newly acquired coal lands for the most part face the railroad right of way. The opening of this coal territory means direct delivery to the Crucible Steel company's plant at Midland, Penn. This company is spending over $5,000,000 in improvements. The exact boundaries of the property acquired by the West Point Coal & Coke Co. have not been announced. However, it extends from about three miles back of Wellsville, north for a distance of five miles to West Point.

Columbus—A ruling by the State Public Service Commission makes the Hocking Valley R.R. Co. liable for a number of damage claims on short weights. A test case was brought, to determine whether or not the practice of underbilling coal 1000 lb. to the car, released the carrier from shortage claims when a car arrived at destination with contents un-

der the weight called for by the shipper's bill of lading. Underbilling has now been done away with, but the case was filed under the old system. Other claims that have arisen will now be pressed. The railroad company will probably carry the matter into the courts.

Massillon—A committee representing the operators and miners of subdistrict No. 3, of district No. 6, United Mine Workers, met here May 1, to draw up a wage contract for the next two years. The cost of supplies, such as oil, powder, and house coal promised to be the principal bone of contention. The committee have no power to change the basic scale of $1 a ton and proportionately increased wages for other kinds of work, fixed by the Cleveland conference in March. They will deal exclusively with questions arising out of conditions that exist in this sub-district.

Pennsylvania

Bituminous

Pittsburg—Maintaining that the reduction of 10c. a ton in the freight rate on coal from Pittsburg to the lakes, recently ordered by the Inter-State Commerce Commission, does not grant them the relief desired or necessary to enable them to compete with West Virginia, the Pittsburg coal operators, through John W. Boileau, with the Pittsburg Coal Co. intervening, have filed another petition asking for a further reduction in the rate. They want the rate reduced to 50c. a ton, the figure named in the original petition; but whether this is granted or not, they hold that the Inter-State Commerce Commission should further modify the rate.

Waynesburg—Josiah V. Thompson and associates of Uniontown have closed a deal by which they have sold to Edward H. Jennings of Pittsburg 2896 acres of coal and 220 acres of surface located in Washington township, Greene County. It is reported that $780,000 was the amount paid. The land is on Ruff Creek. It is west of the holdings of the Emerald Coal Co. and is bounded on the north by holdings of the Westmoreland Coal Co. Thomas Ross of Washington township, Greene County, sold to Thompson, 370 acres of coal land on Ruff creek, for $131,000. The purchase of the Ross property gave Thompson possession of the tract which amounted in all to about 3000 acres.

Du Bois—Reports from the locals of district No. 2, United Mine Workers, indicate that the referendum vote of the men will ratify the wage-scale agreement which was reached at a conference here several weeks ago.

The contention between the Cascade company and their Sykesville miners over the taking in and out of cars has been adjusted and the mine resumed work recently after a suspension of over a month. Not all the men returned to work at once, as it will require some time to get the big plant in full operation and the entire 600 miners and cokers back at work.

The coal mines at Savan, Indiana County, which have had a hard time of it, financially and otherwise, are at last to be opened up and put in active operation. Work was commenced recently on a new tipple and also on a new opening.

Brockwayville—According to reports, the Shawmut Mining Co. is preparing to open up a coal field in the Shawmut valley that has hitherto remained undeveloped. The main opening will be in the vicinity of former operations at Shawmut which have been closed down for several months and sufficient territory will be tapped at once to insure the employment of a large number of men.

Anthracite

Scranton — Women were the leaders in a riot in the Scranton district May 7, leading a force of men in an attack upon repairmen at the Dickson shaft of the Delaware & Hudson Co. at Green Ridge. Forty repairmen were routed by 500 men, women, and children. Four of the 40 fell in their tracks, and two of them were seriously injured. The rioters gathered at the colliery as the 40 men reported for work, which the union had said they were privileged to do. The mob was made up of foreigners, but many English-speaking people joined in the attack because they were led to believe that some wrong had been committed, and that they were justified in taking the law into their own hands.

Wilkes-Barre—At a conference of the general scale committee of anthracite miners and operators, held in New York, May 2, the representatives of the miners refused to accept the terms of the agreement which was reached by the subcommittee of four operators and four miners on Apr. 25. A general convention of mineworkers of the three anthracite districts has been called to meet in Wilkes-Barre, May 14 and the question of ratifying the proposed agreement will be decided at that time. The operators decline to enter into a further discussion of the matter, insisting that the men should endorse the work of their committee. In the event of the miners refusing to do this the proposition of the owners to refer the controversy to a strike commission still remains as a basis of negotiations.

Mayor John V. Kosek has notified the various coal companies with mine workings under the city, to send maps of their mines to the city clerk. The action of the mayor followed a mass meeting of the citizens of North Wilkes-Barre, who have taken steps to protect their homes from surface subsidences.

Shenandoah—Serious riots took place here and at Mt. Carmel on May 6, and some trouble of the kind was also experienced at Mahanoy City. The rioters were Italians. They went armed upon the highways and clubbed and stoned workmen, overran two collieries, and prevented union men from reporting for work, which the union had declared permissible.

At Mt. Carmel, the rioters took up positions along the road leading to the Richards colliery of the Susquehanna Coal Co. Four union men were stopped and the rioters beat them until they were helpless. The rioters then marched to the Sayre colliery of the Lehigh Valley Co. and stretched ropes across the roadway, refusing to permit workmen to leave the colliery, and refusing admittance to those who wanted to work.

At Shenandoah the rioters started marching early. They went to a stripping and drove away the men and then went to the William Penn Colliery of the Susquehanna Coal Co. and the Shenandoah City Colliery of the Reading. Pumpmen, engineers and firemen were driven from their posts and the rioters refused to allow anyone to work. The sheriff sent to Pottsville for a squad of state troopers and they charged the rioters and drove them from the highway. The police remained upon the scene and are patrolling the highway.

West Virginia

Clarksburg—The mine of the High Grade Coal Co. at McWhorter, near here, was placed under a heavy armed guard Apr. 27, following threats of striking miners to blow up the mine with dynamite. The situation in the coal fields became so menacing that calls were momentarily expected to be made on Gov. Glasscock for state militia.

Charleston—The miners and operators who have comprised the subscale committee in conference here formulated a wage agreement on May 1 which was ratified immediately by the miners in convention, while the operators now have the proposition under discussion. Under the new agreement the Kanawha miners will receive one-half of the increase stipulated in the Cleveland wage scale and the semi-monthly payday will be restored. The miners abandoned their demand for the check-off system.

Wellsburg—About 600 acres of coal land, the tipples, cars and equipment of the La Bell Coal Co. have become the property of the Lewis Finley Co. and it is expected that the new concern will greatly increase the coal output of this section.

Welch—Contributions to the Jed relief fund asknowledged by H. N. Eavenson, Gary, W. Va., secretary of the committee, up to May 2, amounted to $12,030.66.

Personals

E. L. Sternberger, of the E. L. Sternberger Coal Co., Cincinnati, recently made a business trip to Chicago, Cleveland, Toledo and other Lake cities.

Carl Scholz and W. H. Skaggs, both of Chicago, Ill., are prospecting a large area of coal land, presumably in the Corona Seam, in Walker and Fayette Counties, Alabama.

William Monay, superintendent of the Central Coal & Coke Co.'s coal mines, at Rock Springs, Wyo., has accepted a position as assistant general manager of the Kemmerer Coal Co., and will enter upon his new duties at once.

Frank H. Crockard, vice-president of the Tennessee Coal, Iron & R.R. Co., has returned to Birmingham from New York, where he attended a meeting of the rail committee appointed by Judge E. H. Gary, of the Steel Corporation, to discuss the betterment of steel rails.

C. P. Collins, civil and mining engineer, of Johnstown, Penn., has been appointed mining engineer of the Berwind-White Coal Mining Co., with headquarters at Windber, Penn. Mr. Collins has leased his engineering business in Johnstown to S. E. Dickey, preparatory to taking up his new duties.

A. B. Jessup, mining engineer of the Lehigh Valley Coal Co., Wilkes-Barre, Penn., has resigned, effective May 1, to become general manager of the J. B. Markle coal properties, at Jeddo, Penn. Mr. Jessup was tendered a banquet by the employees of the Lehigh Valley company, on May 4, and will take up his residence in Jeddo in the near future.

C. P. Ludwig, general superintendent of the Alabama Consolidated Coal & Iron Co., and S. B. Sheldon, of New York, representing a large number of men financially interested in the properties of the Southern Iron & Steel Co. and the Alabama Consolidated Coal & Iron Co., were in Birmingham recently, inspecting the properties of the two companies.

E. Kelly Rothstein, formerly vice-president and general manager of sales for the Davis Coal & Coal Co., has become manager of the Messrs. B. Nicoll & Co.'s coal and coke department, with offices in the Singer Building, New York. The latter company has been appointed sales agent for the Davis Coal & Coke Co. in all territory except New England.

William L. Martin, for several years assistant superintendent of Pratt No. 1 division of the Tennessee Coal, Iron & R.R. Co., who, on Apr. 1, this year, was engaged by the State of Alabama as superintendent of the Banner mine, has resigned this position, effective at once. The Banner mine is being operated with convict labor by the state for the Pratt Consolidated Coal Co., of Birmingham.

Chronology of Coal Mining for April

Apr. 2—Complete suspension of work at anthracite mines of Pennsylvania and at a large proportion of bituminous mines in central competitive field.—Wage increases granted in southern Colorado field.

Apr. 6—Coal strike in Great Britain officially declared at an end.

Apr. 10—Bituminous miners ratified Cleveland wage-scale agreement by a referendum vote of 109,709½ to 32,-139½.—Conference of anthracite operators and miners opened in Philadelphia.

Apr. 18—Fifty thousand miners in Pittsburg district returned to work.

Apr. 20—Central Pennsylvania operators and miners agreed on a two-year contract.

Apr. 21—An explosion of gas in the Coil coal mine, Madisonville, Ky., killed six men.

Apr. 25—Two-year bituminous wage contract formally signed at Indianapolis. —Subcommittee of anthracite operators and miners reached wage-scale agreement.

Apr. 30—Explosion in Hokkaido Coal Co.'s mine, Yubari, Japan reported to have entombed 283 men.—Miners in southwestern field agreed to remain at work pending the signing of a contract. —Explosion in Roden Coal Co'.s mine at Marvel, Ala., injured 8 men.

Book Review

THE USE OF MICE AND BIRDS FOR DETECTING CARBON MONOXIDE AFTER MINE FIRES AND EXPLOSIONS. By Geo. A. Burrell. Technical Paper No. 11, Bureau of Mines, 1912. Paper Covers. 15 pp., 6x9 in. No. illus.

This is a valuable monograph, but as it contains, to all appearance, nothing new, there would seem, therefore, no reason why it should depart from the announced purpose of the bureau to make these technical papers easy for the average miner to understand. How, for instance, he would stumble over the words, "physiologically indifferent," on page 7, is not clear. The bulletin contains a complete account of the properties and sources of carbon monoxide and the dangers to be apprehended from it.

It discourages the prevalent idea that a small percentage of monoxide will form a cap and will warn the miner of danger. Mr. Burrell declares that less than 2 per cent. of carbon monoxide cannot be detected by the use of a lamp, a percentage which would kill a man in a few seconds. Some short remarks are made on the chemical tests used for determining the presence of the gas. The last section treats of the action of monoxide on birds and mice and of their use in exploration of mines after an explosion.

Construction News

Viper, Ky.—The Kelley Coal Co. is considering the construction of a coking plant at Viper.

Nanty-Glo, Penn.—The Estep Coal Co. has under consideration the complete electrification of the Nanty-Glo mine and contemplates making an additional opening.

Salt Lake City, Utah—The Castle Valley Coal Co. has increased its capital stock from $5,000,000 to $7,500,000, to provide a new tipple at Mohrland and make other improvements.

Boswell, Penn.—The Merchants Coal Co. contemplates opening a new mine and making necessary improvements to tracks, yards, etc.; $25,000 will be expended on the erection of miners' houses.

Red Ash, Ky.—The Proctor Coal Co. will develop several additional mines to a total daily output of 2000 tons. Machinery will be electrically driven. Charles F. Finley, Williamsburg, Ky., is president.

St. Paul, Minn.—The Pittsburg Coal Co. has taken out a permit for the erection of a coal elevator on East Eighth St., to cost, with machinery, about $4000. The building will have a storage capacity of 2500 tons of hard coal.

Morgantown, W. Va.—Mine No. 7, of Elkins Coal & Coke Co., is now being opened up, two miles southwest of Bretz, and it is estimated that the actual mining of coal will be under way within three months. A tipple, houses, stores, tracks, etc., are to be built.

Ashland, Ky.—The Kentucky Solvay Coke Co. has purchased a 65-acre site in this city and plans the immediate construction of a large coking and by-product plant. The cost of the plant will total $900,000, it is stated. The tract which has been secured was purchased from the Ashland Coal & Iron Co.

Birmingham, Ala.—A. H. Woodward, vice-president and general manager of the Woodward Iron Co. has announced that $2,000,000 will be spent on improvements to the company's properties. It is estimated that $1,000,000 of this will be applied to the mining properties, but no definite plans for this work have been announced.

Shamrock, Ky.—The Climax Coal Co. has organized with Edward L. Douglass, vice-president and general manager, and has taken over the Edgewood Consolidated operation at Shamrock. It is making numerous improvements. Shaker screens, a washer and other modern equipment are to be installed. The Hignite seam will be opened.

Louisville, Ky.—The Oliver Chilled Plow Works, of South Bend, Ind., is reported to have purchased 15,000 acres of coal and timber land in Harlan County, Ky., for immediate development. The land was purchased from the Wisconsin Steel Co., a subsidiary of the International Harvester Co. The steel company now has several hundred coke ovens in operation in Harlan County.

Cincinnati, Ohio—The Reliance Coal & Coke Co. has determined to expend about $20,000 in modernizing the property formerly occupied by the Cincinnati Gas, Coke, Coal & Mining Co., recently purchased by Julium Fleischmann and associates, at the southwest corner of Blair Ave. and Weatherhead St., Avondale. A new system of overhead trestles, bins and a modern stable will be installed, the work to be started in the near future.

Coal Trade Reviews

Current Prices of Coal and Coke and Market Conditions in the Important Centers

General Review

The opening of the Lake trade and the unexpected deadlock in anthracite have steadied the market up materially. Hard-coal supplies are down to a low point, and the unprecedented action of the miners in rejecting the scale fixed by the sub-committee is causing considerable apprehension among consumers. This has also had a stimulating effect on bituminous and tended to check a further decline in this branch, which has about held its own during the past week. The outlook in soft-coal is not, however, so bright, as there are still evidences of strike surpluses, and some difficulty is experienced in placing the new arrivals which are again about normal.

The Eastern bituminous market is settling down to the usual spring dullness, although fairly active and with a satisfactory movement. The arrivals are mostly on contract and are naturally slow, due to the heavy shipments in March and April. Very little anthracite is coming in, but there is as yet no evidence of any particular distress over the shortage in this grade. Production in the Pittsburg district is increasing, but is still low, probably only about 50 per cent. capacity. The new circular of the Pittsburg operators has not been severely tested as yet, but there is already tangible evidence that it will not hold.

The Ohio mines in the Lake trade are starting up and operators are anticipating a banner season in that market this year. Production in West Virginia has eased off some, but the tonnage dumped at the Virginia piers during April was the highest on record. The union mines in the western Kentucky fields are still closed, and the demand is light, although a good season is expected. In the Middle West there is a fair buying movement, principally from the railroads and large steam users, and the market is somewhat stronger.

Boston, Mass.

The bituminous market is settling down to the usual spring dullness. Prices are easy on only a slightly higher basis than last year, but buyers are not showing the interest that was expected. The few cargoes of Southern coals that arrive are mostly on contract and for the largest consumers. Inland trade is well supplied for the present and it will take lower prices than now prevail to induce any buying, ahead of actual needs.

Reading transportation is still available for bituminous out of Philadelphia and a fair tonnage is coming from Pennsylvania in that way. All the shippers are in a position to clear boats promptly. Transportation generally is easy, with rates from Hampton Roads at 70c. or less for large boats.

Shipments all-rail are rather slower than usual for this season, due to the heavy volume moving in March and early April. Few contracts are reported placed, and those only by large concerns, and at prices little if any in excess of last year.

The news of the disagreement in the anthracite scale conferences, following the meeting May 2, came as a surprise. If negotiations are much further extended the dealers will be getting apprehensive again. There is practically no premium coal offering, and so far as the trade goes, hard coal is at a standstill.

In Boston retail contract prices on soft coal are $4.50 to Oct. 1, and $4.75 from Oct. 1 to Apr. 1, net tons delivered, or 25c. higher than last year.

Wholesale prices are about as follows:

Clearfields, f.o.b. mines	$1.10@1.35
Clearfields, f.o.b. Philadelphia	2.40@2.60
Pocahontas, New River, f.o.b. Hampton Roads	2.70@2.80
Georges Creek, f.o.b. Baltimore	2.60@2.70

New York

The refusal of the anthracite miners' full committee to ratify the agreement reached by the subcommittee, resulted in a decided stiffening in the hard-coal market here the early part of the week. While the larger companies continue to quote their regular circular, they concede that there is little or no coal available at these figures, and that there are prospects of an acute shortage should the lockout continue. Coincident with the announcement of a break in the wage-scale conferences, the dealers withdrew the low prices put in effect May 1 on the supposition that this matter had been settled, and domestic is now back to the full March circular.

The bituminous trade, in sympathy with the anthracite, developed some strength during the past week, in that no further decline was in evidence, as has been the case during the past month. Spot quotations are slightly higher than last week, the lower grades being quoted around $2.65, f.o.b., with the better grade Pennsylvanias about $3.05. Some demurrage coal was disposed of at $2.50, but this cannot be considered the market. The trade reports plenty of fuel available, and the large operating companies say the mines are working well up to capacity and normal tonnages for this period are coming in.

The anthracite companies do not expect operations to be resumed at the mines before June 1. While buyers in the open market find it necessary to pay substantial premiums, the companies continue their regular circular as follows:

Broken	$4.50
Egg and stove	5.00
Chestnut	5.25
Pea	3.25
Buckwheat	2.75
Rice	2.25
Barley	1.75

Pittsburg

Bituminous—There has been a slight increase in activity at the mines in the Pittsburg district, but production is still far below normal and hardly amounts to more than one-half capacity. The stocks accumulated by consumers are still in evidence, so that buying is light. Shipments in the lake trade were started May 1 but have not yet reached important proportions, little coal being loaded since navigation is only getting started. Only a few vessels started last week on the down trip from the head of the lakes, ice having interfered to a much later date than usual. The new season prices have not been seriously tested as yet, but there is already tangible evidence that they will not hold universally. We repeat them, however, as there is no other basis for quotation: Mine-run and nut, $1.22½; ¾-in., $1.32½; 1¼-in., $1.47½; slack, 82½c. per ton at mine, Pittsburg district.

Connellsville Coke—Production is back to normal, about 400,000 tons weekly, and the prompt furnace market has grown still easier. There is little coke offered, but demand is almost equally limited. There have been negotiations on second-half contracts for furnace coke, but none appear to have reached a head yet. There is no reason to believe the recent report that a contract for the second half has been made at $2.35. Foundry coke continues in fair demand. We quote: Prompt furnace, $2.40@2.50; contract (nominal), $2.25; prompt foundry, $2.75; contract foundry, $2.40@2.50, per ton at ovens.

The *Courier* reports production in the Connellsville and lower Connellsville region in the week ending Apr. 27 at 401,-

494 tons, an increase of 5000 tons, and shipments at 4313 cars to Pittsburg, 6281 cars to points West and 1288 cars to points East, a total of 11,882 cars, or an increase of 228.

Philadelphia, Penn.

The unexpected developments of last week entirely changed the situation in the anthracite trade. It was confidently expected that it was a mere matter of form for the general committees to confirm the findings of the subcommittees of the operators and miners, but opposition developed which will more than likely postpone operations at the mines for at least a couple of weeks. The first of June is now the prediction for a resumption of work at the mines, and this entirely dependent on the attitude of the convention to be held on May 14, at Wilkes-Barre.

The idleness of the mines is not, however, causing any particular stress up to the present time. There seems to be a fairly plentiful supply of coal for domestic purposes, and the storage supplies acquired by the manufacturing interests and other steam users early in the spring, seem to be holding well. Of course, some sizes are very short, notably pea coal, and this seems to be the rule rather than the exception, although there are a few dealers who are fairly well stocked on this size, and claim that they have sufficient to carry them for a month or so.

Spasmodic arrivals of anthracite are reported, some domestic sizes and a little buckwheat coming in, but most of the dealers are doing very little beyond looking forward to the announcement of prices and the resumption of work at the mines. Nothing definite has been announced as yet regarding prices or what the policy will be, and the operators are noncommital when asked as to what changes, if any, are likely to be made. The invariable reply is that prices will not be discussed until there is a definite understanding with the miners, and until this takes place, it is useless to speculate.

Baltimore, Md.

A strike among the laborers employed at the coal piers of the various railroads in Baltimore, arose during the past week, which seriously interfered with business in the local market. For two days matters were simply at a stand-still at both the Curtis Bay pier of the B. & O. R.R., and the Port Covington piers of the W. M. Ry., and as the differences between em ployers and employees have not yet been settled, there is no telling just how long present conditions will continue. The laborers employed to unload at the piers have been receiving 20c. per hour, while the coal trimmers, who handle the fuel after it is loaded on the steamers, have been paid 25c. per hour. The men have struck for an increase of 5c. an hour, and recognition of their union. The railroads will probably act together in any settlement which might be made.

Buffalo, N. Y.

The bituminous market sagged slowly all the week, till there came news that the anthracite miners might not go to work right away, when there was a visible stiffening. After two or three days it again looked as though there would not be a strike, which left the market weak again. There is plainly more bituminous coal mined than is needed, even though a good many mines returned to work only partially, or to meet business in sight. A week ago the reports made by the bear members of the trade that they could get Allegheny Valley mine-run for 95c. at the mines was stoutly denied by operators, but there appears to be much truth in the statements now, though some mines are refusing such offers and would close rather than accept them.

All that can be done in the line of quotations is to repeat former figures, which some are getting and some not, as follows: Pittsburg three-quarter, $2.87½; mine-run, $2.47½; slack, $2.25, with Allegheny Valley about 25c. lower. Coke went too high and is now suffering a reaction, being down to $4.50 for best Connellsville foundry.

There seems to be plenty of anthracite in Buffalo and none of the consumers have so far complained, but there is none for Lake shipment, though the demand in that branch of the trade is urgent. It now looks as if it would be impossible to meet that demand this season, even if mining should begin very soon. The anthracite operators always take care of the Eastern trade first and regard the Western trade as a sort of an overflow.

Columbus, Ohio

Within the past week, mines have started up in both the Hocking and eastern Ohio fields; this activity is confined largely to the lake-shipping companies. Though the ice in the upper channels makes it uncertain as to when the first fleets will be able to move, cargoes are being taken on by boats in their winter quarters at the Ohio ports. Coal will also be loaded on cars and held at the mines ready for movement to the docks as soon as navigation is fairly under way.

Aside from the Lake trade, the market is lifeless and mines might remain idle for several weeks to come without inconvenience. Stocking of fancy domestic coals, which usually sets in early in May, is slow, as dealers seem inclined to take a breathing spell after an exceptionally busy winter and spring. The prospects, however, are for an excellent business along this line. Owing to the increased cost of mining, producers will attempt to hold summer domestic prices well up to the formal circular of $1.50, although this figure will probably be subject to some shading at the outset.

Fine coal is on the down grade with respect to price, because of the large tonnage that will soon accumulate as a by-product of lump in the Lake trade. The average selling price has dropped to 75c. and there is only a fair demand. Railroad fuel and mine-run for general industrial purposes is suffering from a period of readjustment, many big consumers still having storage on hand. This is having a bad effect on the closing up of contracts. Many large steam users seem inclined to take a chance on the open market for the coming year's requirements.

Hampton Roads, Va.

While there appears to be a lull in the market, coal has been moving quite freely through Hampton Roads this week, and prices are still good, though probably from 10 to 25c. less than last week.

Shipments here during the month of April set up an enviable record, reaching the high mark of 1,213,164 tons, and exceeding any previous for a month's loading at this port. These figures exceed by 94,014 tons the shipments during the month of March, which hitherto had been the record month, and is at the rate of 14,557,968 tons a year.

Both the Norfolk & Western at Lamberts Point and the Chesapeake & Ohio at Newport News, broke all their previous records. The Virginian Railway at Sewalls Point fell considerably below its usual dumping and was the only rail road that did not have a big month, which was due to washouts and other troubles.

Lamberts Point easily led the others, having a total dumping of 571,187 tons during the month, or an average of 21,968½ tons a day for the 26 working days. Newport News was second with a total dumping of 475,801 tons, while Sewalls Point was last with 166,176 tons.

From present indications the coal railroads at Hampton Roads are entering upon the greatest prosperity in their existence. While a great part of the increase in shipments from Hampton Roads was caused by the strike in England, considerable of the business will be held. The English strike was the opening wedge for Pocahontas and New River coal shipped from Norfolk and Newport News into ports heretofore supplied by Welsh coal exclusively and it has proved so satisfactory that new and steady markets have been opened.

Charleston, W. Va.

Practically all the mines in the Kanawha district are again in operation, after about two-thirds of them had been idle for a month, owing to the failure of the operators and miners to get together on the wage question. The settlement of the difficulty late last week was due to

the miners waiving the check-off and the operators granting an increase of one-half of the Cleveland scale. This means an increase ranging from 3c. to 5c. per ton, an increase in all other labor, and the two weeks' pay. Many of the operators had been willing for some time to give a small increase, providing the check-off was waived, but all efforts earlier in the contest failed because the miners were willing to concede everything as a compromise, providing the operators would agree to the check-off. The latter concession, however, the operators of the district absolutely refused to grant under any condition.

It is expected that before long, many of the cars that have been used in this section will be returned to the roads which loaned them, and that West Virginia will then again suffer through a lack of cars.

Birmingham, Ala.

The Birmingham coal market maintains a satisfactory firmness with bright prospects for the year. The most vital factor affecting the market during the week has been the advance in the wages granted a large percentage of the Alabama miners. The advance was 2½c. per ton, effective May 1, for all operations on what is known as the Pratt seam. Practically all mines were compelled to follow some of the leaders who agreed to make the advance.

Contracts for domestic coal which have been pretty well concluded for the year, were negotiated at a slightly better price than last year. In the Alabama market, domestic coal contracts are largely covered during April and steam contracts date from July 1.

The commercial coke plants are running full capacity in Alabama with a ready market at firm prices. The Alabama coke producers have not followed Pittsburg and Virginia in coke advances, for the reason that Alabama's general prices are higher than in Pennsylvania and Virginia and local labor conditions have not operated against production as in the more northern market. Standard 72-hour foundry coke is very firm at $2.25@2.50 per net ton at Alabama ovens, with retort grades quotable at from $2.75@2.85 per ton at ovens.

Nashville, Tenn.

The union operators in the west Kentucky field on the L. & N. R.R. and I. C. R.R. have not as yet effected a settlement and their mines are still idle. There have been many conferences held between the operators and miners in Louisville for the past six weeks. A meeting was held last week in which the operators delivered their final ultimatum and this is to be acted upon this week by a referendum vote of the miners in this district. It seems as though the principal contention has been to get a correct interpretation as to the meaning of the Cleveland agreement.

The nonunion mines in this field, located both on the I. & N. and I. C., have been supplying all the coal from this district. As the demand is light they have been able to do this very easily, and at the same time it has given them an unusually good tonnage for this season of the year. There is very little request for any coal except the finer grades, which are in great demand at high prices.

It looks as though better prices will prevail on contract coal for the coming year and a rather good season is looked forward to by the mining interests in this field.

Chicago

While coal dealers are not inclined to make predictions, it is regarded as certain that the present buying movement will absorb a very substantial amount of coal during May. It is expected this will increase in vigor during the latter part of the present month. At present the buying comes principally from the railroads, although there has been a certain amount of business coming from the users of steam coal who recently found themselves at the end of their resources. This enables the commercial mines to continue doing some business, but it is not expected these mines will have a big market until toward the end of May.

The coke market is active and spot business in furnace and foundry coke is fairly good at firm prices. The supply of Indiana and Illinois coal is not sufficient now to warrant any fixed market quotation.

Prevailing prices at Chicago are:

Sullivan County:	
Domestic lump	$2.62@2.87
Egg	2.50@2.75
Steam lump	2.17
Screenings	1.67@1.82
Springfield:	
Domestic lump	$2.57@2.82
Steam lump	2.17
Mine-run	1.97@2.07
Screenings	1.67@1.82
Clinton:	
Domestic lump	$2.52@2.77
Steam lump	2.17
Mine-run	1.97@2.07
Screenings	1.67@1.77
Pocahontas and New River:	
Mine-run	$3.15
Lump and egg	$3.30@3.55

Coke—Prices asked for coke are: Connellsville and Wise County, $4.75; byproduct, egg and stove, $4.55; byproduct, nut, $4.55; gashouse, $4.75.

Indianapolis

There is nothing particularly encouraging about the coal-mining industry in this state. Both operators and miners are greatly disappointed because the mines have not resumed work. The operators say that orders are piling up and the scarcity of coal in localities is becoming acute. Public institutions and manufacturing plants are borrowing coal of railroads fortunate enough to have some in storage.

When the joint conference of operators and miners meets again, it will be to hear a report from a policy committee composed of Kelsheimer and Stewart for the miners, and Hewitt and Gould for the operators. The operators, notwithstanding their desire to open the mines, seem determined to refuse to enter into negotiations until the men return to work, and the men are as determined to obtain some of their demands first. It is said that President Walker, of the Illinois United Mine Workers, has promised money to aid the Indiana miners during the prolonged deadlock.

Minneapolis—St. Paul

Coal trade in the Twin Cities and the Northwest is still very inactive, and the majority of coal men look for another month of quietness before business will be normal again. Prices have been received on Pocahontas Smokeless, Splint, Hocking and Youghiogheny Coals, and contracts are being let at 10c. per ton less than circular prices prevailing last year on all these coals. Contracting this year has not been quite as heavy as last, owing to the fact that the shipper has not known where he was at in the way of prices, but of late many contracts have been signed and it is rumored several of the larger ones have been made at a low price.

Franklin County and Harrisburg coal is being quoted at $2 and $2.10 on lump, egg and nut sizes at mines, screening from $1.10 to $1.30, and Carterville and Springfield district coals are quoted at from $1.75 to $2 for lump and egg, f.o.b. mines. The retail business is very quiet and will probably continue so.

St. Louis, Mo.

Mining has been partially resumed in Illinois, although on a very small scale. Mines in practically all the districts in southern Illinois are working, but in some sections there are but two or three that have started up.

There is absolutely no demand, and that produced is sometimes held at the mine for a couple of days until a market is found. It is evident from the prices quoted that several operators are not figuring the new insurance feature. The casualty companies are asking approximately $12 on each $100 of the payroll, as they claim it is impossible to do business under the recent Illinois law at a figure less than that.

There would be a good demand in St. Louis for anthracite, were it possible to get any, and smokeless is not as lively as it might be. The same applies to coke, both byproduct and gas house. There is nothing to indicate that the market will

pick up on any of the fuels in St. Louis in the immediate future, and it opened the earlier part of the present week, as follows:

Carterville	
6 in. lump and 3x6 egg	$1.50
2x3 nut	1.35
Screenings	1.00
Mine-run	1.10
Standard	
2 in. lump	$1.05
2 in. screenings	0.90
Mine-run	1.00
Nut	0.95

Portland, Ore.

While oil is being substituted for coal in a good many instances, it is also true that coal is taking the place of wood, particularly in sections where the forests have been thinned out. It is pointed out that could coal be obtained at a little less cost it would soon make a heavy inroad on the demand for wood fuel.

The coal trade in Portland is not very active at this time of year because spring is well advanced, but dealers report business this year about equal to the average for May. There has been no change in quotations here and it will probably be another month before storage prices are put into effect.

Receipts of coal are light in that the stocks are pretty full and it is not expected there will be any heavy shipments again until next fall.

San Francisco

For the past two or three weeks the local trade has been very quiet and the movement far from brisk. On the other hand, deliveries of domestic have been exceedingly meager, and as a consequence the stock on hand has not decreased.

The arrivals up to nearly the close of last month consisted of 4971 tons of Australian and 4593 tons of Wellington. The U. S. Government has received three cargoes of Pocahontas for the Navy, aggregating 16,683 tons, and the Pacific Coast Co., 4524 tons of steam coal from its Washington collieries, for use on the coast steamers.

The receipts of Rocky Mountain coal have been fairly good, considering prevailing conditions.

Prices to the trade are as follows per ton:

Wellington (British Columbia)	$8.00
Pelau Main (Australian)	8.00
Rocky Mountain	8.50
Anthracite (Lehigh)	15.00
Cumberland	12.50

Production and Transportation Statistics

The Car Situation

Increases in number of idle coal cars were most noticeable through the Middle Atlantic States and Middle West. In the Middle Atlantic territory the car surplus jumped from 22,500 to almost 50,000, and in the Middle West the increase during the fortnight exceeded 100 per cent. Both of these sections have on hand a comparatively large number of idle cars, although the present surplus of cars in the Middle West is not as large as the surplus at this time last year. In the Northwest there was about a normal number of freight cars idle. While the increase in the box-car surplus was not as marked as the gain in coal cars, it was by no means confined to any particular section of the country. There was a better demand for box cars in Montana, Wyoming, Nebraska, and on Canadian lines, but not sufficiently large to reduce the total surplus in those territories.

The following table shows the surplus and shortages of cars on 169 roads on Apr. 25 last:

	Surplus	Short	Net Surplus
Box	19,583	6,152	13,431
Flat	6,857	1,613	5,244
Coal, gond. and hopper	94,692	2,144	92,548
Other kinds	30,054	2,396	27,658
Total	151,186	12,305	138,881

Various Railroads, Rivers and Canals

The following is a comparative statement of the fuel movement over various railroads, rivers and canals for February, 1911-12[1]:

Railroads	1911	1912
Baltimore & Ohio[2]	2,187,226	3,397,088
Buffalo, Rochester & Pittsburg[3]	612,341	790,801
Buffalo & Susquehanna[3]	157,031	167,375
Chesapeake & Ohio[2 4]	1,530,710	1,337,216
Erie[4]	637,734	721,481
Huntingdon & Broadtop Mountain[2 3]	83,127	136,811
New York Central & Hudson River[2]	632,564	706,573
Norfolk & Western[2 3]	1,402,765	1,922,225
Pennsylvania (east of Pittsburg & Erie)[2 5]	4,646,198	6,217,396
Pittsburg & Lake Erie[2 5]	1,023,056	1,476,748
Pittsburg, Shawmut & Northern[3]	114,239	202,137
Southern[4]	358,917	451,081
Virginian[2 3]	162,343	294,041
Western Maryland	192,284	255,063
Rivers and Canals		
Canals and Falls at Louisville	239,173	18,050
Chesapeake & Delaware Canal	8,193	2,700
Davis Island Dam	448,160	101,245
Green River, Lock No. 1	2,202	1,356
Kanawha River	93,580	78,320
Kentucky River, Lock No. 1	6,100	4,600
Monongahela River	1,005,461	450,352

[1]Figures throughout this table have been reduced to a uniform basis of short tons.
[2]Includes coal received from connecting lines.
[3]Includes company's coal.
[4]January figures.
[5]Does not include company's coal hauled free.

Foreign Markets

Russia

Bituminous-coal production of the Donetz district for 1911 was 16,607,600 tons, as compared with 14,013,390 tons for 1910 and 14,952,745 tons for 1909. Production of anthracite in 1911 was 2,903,870 tons, as compared with 2,398,000 tons in 1910 and 2,546,300 tons in 1909. The production of coke was 2,705,000 tons in 1910, as compared with 3,292,000 tons in 1911.

France

The imports of coal into France during the first two months of this year totaled 2,751,400 tons, as compared with 2,906,000 tons in the corresponding period of 1911. The imports of coke for the same period of 1912 were 388,900 tons, as compared with 446,200 tons in 1911, while the imports of briquettes were 204,300 tons, as against 207,000 in 1911. The exports of coal during the first two months of 1911 were 192,736 tons, as compared with 356,209 tons for the same period of the current year. Coke exports during this same period of the current year were 27,831 tons, as against 30,488 tons in 1911.

Austria-Hungary

During 1911, 10,872,928 tons of coal were imported into Austria-Hungary, as compared with 9,864,462 tons in 1910 and 10,482,264 tons in 1909. The imports of coke in 1911 totalled 702,707 tons, as compared with 670,089 tons in 1910, and 701,281 tons in 1909.

Exports of coal during 1911 were 609,737 tons, as compared with 615,082 tons in 1910, and 633,253 tons in 1909. Coke exports for 1911 were 299,915 tons, as compared with 230,735 tons in 1910, and 198,313 tons in 1909.

Financial Notes

The Lehigh Coal & Navigation Co. has listed $3,000,000 collateral trust 4½% gold power bonds, due Dec. 1, 1921, and $1,750,000 collateral trust 4½% gold bonds due Nov. 1, 1930, on the Philadelphia Stock Exchange.

Although comparatively speaking the Nova Scotia Steel & Coal Co.'s earnings are small, 8% has already been paid on the preferred stock, the issue amounting to $1,030,000. In 1909 a common stock dividend of $1,000,000 was distributed, which increased the total outstanding to $6,000,000.

It is estimated that the Pittsburg Coal Co. will benefit to the extent of $1,160,000 a year by the ruling of the Interstate Commerce Commission in reducing the freight rate to lake ports 10c. per ton, but this will be offset to some extent by the increase of 5c. a ton in wages to miners. The net advantage to the company, however, will be about $600,000 a year.

The Delaware & Hudson coal operations during 1911 included the mining of 7,280,939 tons of coal, an increase of 633,280 tons. Gross revenue from the coal mining department was $13,355,014, an increase of $1,548,126 over 1910; gross expenses amounted to $13,238,304, an increase of $1,790,077, leaving a net revenue for this department of $116,710, a decrease of $241,951 for the year. Construction and betterments included in the coal department expenses amounted to $823,654, as against $766,673 in 1910.

In the year to June 30 last, the Philadelphia & Reading Coal & Iron Co.'s income account wound up with a loss of $103,316. For 1910 the loss was $71,500 and for 1907, $71,482, an aggregate deficit for the three fiscal periods of $246,298. In 1909 and 1908 profits of $66,973 and $207,523, respectively, were shown, or $274,496 in total. Thus the net profits for the five years were $28,198. This only partially measures the unprofitableness of Reading's coal business, as the foregoing balances make no allowance for full interest on capital invested in coal lands.